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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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Combined Issues

AS A RESULT of the strike we have lost four issues of *Engineering News-Record*. We are faced with the alternative of dropping them entirely or of catching up by getting out issues with greater frequency and increasing the amount of reading matter in a certain number of issues. We have decided on the latter course. From now until the end of the year we expect to put out a copy of the paper every five days, combining eight issues into four. This issue, therefore, carries the dates of Oct. 30 and Nov. 6. By the making of these combinations, the bound volume will show all serial issue dates and thus avoid confusion in later years. Each of the combined issues will carry additional text matter, principally in the technical section. The departments—editorials, letters to the editor and the news—will remain about normal. We shall not, even by these expedients, make up a volume of reading matter equivalent to what we have lost, but we will give weekly far more than even the studious reader will be able to digest. Thus, while not living up to our normal intentions, we believe that we shall fully satisfy all our readers, and that whatever loss there is in total pages they will gladly stand as their contribution to the winning of the strike. By doubling up issues and publishing every five days we shall get on normal schedule again at the beginning of the new year.

A Series of Transportation Monographs

THIS issue concludes the second of three monographs on transportation prepared for *Engineering News-Record* by its consulting editor, Charles Whiting Baker. The first was a comparison of the cost of hauling by rail and by motor truck, published July 10, 1919; the one now concluding is on the railroad problem, while the third, which will appear within 60 days, is on waterways. These three monographs, representing substantially a year's investigation and study, were prepared in recognition of the vital bearing of transportation on our economic life. We need not repeat what everyone knows, that failure to handle effectively our railroad problem will bring widespread disaster. Anyone who can make a real contribution to the solution confers a public benefaction. Equally sound reason underlies the monographs on truck haulage and waterways. Motor trucking is a form of transportation of growing importance. Within what limits is it economical? Where is the line of demarcation between economical truck and railway carriage. These questions Mr. Baker sought to answer in July. The remaining monograph—by far the longest—is a most vigorous and scholarly discussion of the waterway problem. It handles the subject without gloves, and will come as a tonic after all the wishy-washy thinking and wild-eyed propaganda on waterway improvement.

Coal and Construction Materials

THE coal situation is so very serious that one must put in the background personal interests, yet engineers and contractors should know that the present short market will be made shorter still by the stoppage of practically all plants producing structural materials. The brick plants, both building and paving, the lime kilns and the cement mills, have been shut down on account of coal shortage, and the steel output is being curtailed. This will react seriously on an already unsatisfactory building situation, to say nothing of the unemployment and loss that will occur in these structural-material industries themselves. Serious as this situation is, it takes the second place to domestic and public-utility necessities. The Government has been struggling with the situation, but the time is here when action is necessary to prevent severe suffering. If reasonable compromise will not bring a general return of the strikers, there will have to be military protection to let those work who wish to do so, and possibly also military operation of the mines. Coal must be had.

The New Industrial Conference

WITH the appointment of a new group to study the industrial situation, the President falls back on a theory diametrically opposite to that on which the abortive National Industrial Conference was called together. The theory of the first attempt is that on which we have generally acted in the composing of industrial disputes—that the two parties at issue should come together presenting their respective cases, with an arbitrator to endeavor to get either or both of the parties to accept compromises. The theory of the new effort is that the public, the chief party at interest, should take up the whole problem as it sees best and, through the fairness of its findings, impress its solution on the parties at odds. Proceeding on that theory, the President—in part, at least—has selected well. In Herbert C. Hoover he has picked a man as sound in his thinking as he is able in administration. In Oscar S. Straus, in former Attorney General Wickersham, in Dr. W. C. Thompson, in Julius Rosenwald, he has chosen clear thinkers, each with a different angle on the problem but having in common a deep sense of the obligations which the parties to the controversy owe to the public. With the others we are less well acquainted; that they are broad-gaged can be taken for granted. If that be so, there is leadership enough in those mentioned by name to give warrant for hoping for a good result. Of course, it is not conceivable that any body should be able to bring instant or early industrial peace, but there should be the possibility of enunciating a program which the public could take hold of and gradually and systematically force upon employers and employees.

Paternalistic Standardization

GOVERNMENT officials should not be held too strictly to account for statements they make before a Congressional appropriation committee. The science of wheedling necessary funds out of reluctant Congressmen calls for tactics directed mainly to that end. But the suggestion of the Director of the Bureau of Standards for the routine commercial testing of cement by the Government, as noted on p. 671, should not be passed unnoticed. Whatever is the intention of those in charge of the bureau, the idea of a series of warehouses loaded with Government-tested cement for sale to whoever would buy exceeds the bounds of toleration. Passing by the obvious sales difficulties inherent in such a scheme, and avoiding here, at least, the ready arguments against Government competition in what is not a matter of public service or interest, the issue may be clearly stated. Do we want an official control of materials in this country? Doubtless the bureau would deny any such intention, but the time to stop any such tendency is when it begins. If cement, why not steel and if steel then canned beans and motor tires? Already the bureau is working on standards for the technical performance of public utilities and on safety ordinances, so the range of its ambition is catholic. Some definite restriction must be made, some limit fixed to the functions of a Government research and standardization body.

Business for Breakfast

EXTENSION of the discussion period, when interest in any subject outlasted the time scheduled for its consideration in regular session, was accomplished at the Cleveland convention of the Construction Section of the National Safety Council by inaugurating breakfast clubs. When, at a session, it came time to proceed with the next item and discussion was still active, the chairman called on one of those who had been leading the debate to head a breakfast club and asked those who wished to continue consideration of the subject to meet with the leader. Each morning of the convention witnessed a number of these breakfast clubs and from experience at some of them the editor can testify that they were successful in clearing up debated questions and in creating personal contacts difficult to form in the regular sessions. Not the least important advantage of the practice is that it expedites the proceedings by providing a by-pass for an unexpected volume of discussion on subjects not of wide interest to the members generally. The idea worked at Cleveland lets everyone interested come in on the dining table discussion.

The Common Basis of Professionalism

THE discouraged seeker after light in this troubled age would have found consolation in the atmosphere that pervaded the Inter-Professional Conference that met in Detroit last week. There was frank confession of failure to fulfill the primary professional obligation, that to society, but when the speakers turned to the future they collectively pictured an appreciation of the duty to the public that was inspiring. If that which they pictured could be made fully operative in the profession, if those standards could be carried forward strongly so that the public would force them on all the manifold activities of life, the ills of the minute would disappear in direct measure with the extent of acceptance.

Manifestly, overnight conversion of the professions is not possible, and the conferees did not belittle their task. But there are stirrings in every profession, groups here and there struggling to have the highest ideals accepted within their ranks, that justify not merely a beginning of inter-professional discussion but also the hope that a force of great power can be generated with reasonable speed.

Nor must it be thought that the conferees lost themselves in idealism and forgot the conditions in which and with which they must work. In fact, the whole purpose was to see how forces could be united, first for mutual strengthening in professional faith and, second, for developing methods of attack on actual problems. When a dentist described a ten-year campaign to convert his own profession to advocate preventive rather than corrective work, when a surgeon told the story of war coöperation with architects and sanitarians in order to get the best results, when an architect explained how the whole city plan must be his first concern and not the interest of a client who wants a certain improvement on a certain plot, the ground was never far away from the conferees' pet.

Yet it is true that ideals controlled the conference. The business of the new body is to translate ideals into action. The dominant thought was that the profession —that professional men and women—must see that all their work promotes first the public interest. Inhibitions are recognized—indifference and selfish interest within the professions and without—and those present frankly blamed the professions themselves for conditions rather than the outsiders. They recognized that their obligations spring from the "heritage of knowledge and skill" which the ages have accumulated and with which they, for a brief span, are privileged to work. That heritage was accumulated by the whole people; to them it belongs. They have a right to demand that it shall be used in their interest, not against them; and whereas they have the right to demand, the professional man is under obligation to deliver.

It may be said that those in callings other than the professions are similarly utilizing the accumulated knowledge of the ages, and have a similar obligation to the public. That is exactly true, and it is the failure to discharge this obligation that is responsible for the present untoward social conditions. If all business had, since the modern industrial period began, been run with an eye first to the interests of the public—not merely as to the character, use and quality of the product, but to the effect on the operatives and the local community—we should be lacking in our labor difficulties, in our slums, in our overgrown cities, etc., of the present day. This is not a new thought. Everywhere we hear the idea that "business must become socially minded." For a generation we have been enacting laws to bring it about. We have tried to clip the fangs of the trusts, we have established workmen's compensation laws, we forbid the working of women at night and of young children, we demand safeguards in hazardous occupations.

So, the Inter-Professional Conference was merely in tune with the accepted theory of the present day. It sounded its note higher and clearer than we get it in the mart or the factory. There was no discordant note of compromising the public interest for the sake of profit. Therein lies its strength, that it comes from the

only group that is even measurably free from sordid interests. Only this group can be the leaven that shall lighten the whole lump.

Mr. Baker's Solution of the Railroad Problem

NO EXPLANATION needs to be offered for the use of so many pages of this issue and the last for the discussion of the railroad problem. We are in a precarious position. The railways are struggling along with equipment and facilities inadequate for even the traffic of the moment If that large production should come for which we are all pleading, the roads could not handle it. In fact, it is probable that a production representing even a 50 per cent. average increase in efficiency of all workers would be impossible of attainment due to the sheer inability of the railways to carry the raw materials to the operatives. To prepare the roads for the traffic which normal peace operations should offer will require, according to Samuel O. Dunn, editor of the *Railway Age*, the expenditure of $6,000,000,000 in the next three years.

With this situation confronting us—the railroads hampering our industrial life—we find them mistrusted by the public, disorganized through war-time Government operation, stripped of all credit by inadequate revenues—in fact, in certain bankruptcy were the Government's sustaining power withdrawn.

In this predicament what solution does Mr. Baker offer in the monograph concluded in this issue? He goes to the root of the difficulty, which is the lack of confidence on the part of the public in railroad management, and proposes that the railroads be managed by public corporations, composed of a directorate elected one-third by (1) the stockholders, one-third by (2) the officers and classified employees, and one-third by (3) the public. A fixed return would be allowed the stockholders; the question of sharing in profits above the fixed return he leaves open.

This solution, while obviously not satisfying extremists in either the labor or banker ranks, meets the generally conceded essentials. It provides a basis for public confidence; it eliminates stock-manipulation of properties; it places service to the public first; it retains private ownership and private operation, though in the operation two-thirds of the control lies with nonowners —the public and the railroad employees.

Obviously, such a plan would be experimental. But any plan that deals adequately with the situation must be so. It must, therefore, be examined on the basis of its probable feasibility. The charge most likely to be made against it, is the unfairness of removing control from the owners. We should fear that ourselves were safeguards not erected for chosing the controlling two-thirds of the directorate. One-third would be nominated by the officers and employees, with the former probably exercising the predominating influence; that should insure the selection of efficient railroaders. The other third would be nominated by business and civic organizations, and would probably be business men of proved worth. Nominations would be subject to the *visé* of the Federal Railroad Board, whose political slant, if it had one, would hardly go so far as to play politics with the nominations of business organization and the officers of the roads. The public interest would be too strong to permit of such political use.

Yet while the plan is new we have had something in the way of precedent in the joint public and private control of the street-railway systems of Chicago and Kansas City. The Chicago systems under this joint control was entirely rehabilitated, and the feasibility of the plan proved. The Kansas City arrangement is of relatively recent date.

Mr. Baker's strictures on the past conduct of the Wall Street railroaders are severe, but deserved. With close supervision of financing as the sole change in railroad supervision much of the speculative danger would be removed, but we believe that even this removal would not restore the Wall Street type of management to public favor. Even if profits were to be restricted we should expect the public to be dubious about placing these enormous powers again in the hands of private corporations. In any event, the supervision would be so close and the restrictions on the freedom of the operators such as to amount to Government conduct of the properties. Facing this almost certain result, Mr. Baker takes a bold step forward and suggests a solution that will at once restore public confidence, while retaining private ownership and avoiding the evils of public operation. His solution, as we see it, offers hope that the drift which Colonel Wilgus and Mr. Lindenthal believe will inevitably result in public ownership may be checked. After all, the great majority of the public do not actively desire public ownership. They may stand by with folded hands and see it come, merely because they have been dissatisfied with past management. What they do desire, though, is a conduct of the properties in the public interest first, and the elimination of the stock-jobbing and property-busting of the past. If they can be assured of these things they will be willing to see the properties continue to be privately owned.

With one part of Mr. Baker's discussion we are in accord only if suitable qualification be understood. At the end of Chapter VI he points out that the surplus should be applied to amortization. With a reasonable rate of amortization, of course, we are in accord, and it is such a rate to which Mr. Baker has reference. In fact, it is not conceivable that a high rate of amortization could be provided for in the tariffs. Nevertheless, the inference might be drawn that speedy amortization is desirable in order to eliminate private capital. That, in our judgment, would be undesirable. The retention of private capital is one of the strongest features of Mr. Baker's scheme. The proprietary interest would always have to be reckoned with, and would be an effective barrier against political footballing. It would, moreover, prevent that indifference to the volume of investment which is characteristic of Government enterprise.

Obviously, a day may come when a stationary population will have allowed the railway system to be developed to a reasonable maximum. With great traffic density, fairly rapidly amortization, with the title to the properties correspondingly accrung to the public, would then be possible, but that day is so far away as not to figure into present calculations.

The Baker plan appeals to us, then, as worthy of the most careful consideration. It avoids radicalism, but in so doing it does not fall into the error of most, if not all, of the other conservative plans, in failing to meet all the essentials. Above all, it gives that assurance of the winning of public confidence without which no plan can succeed.

An Appraisal of Modern Plant Performance in Concrete Road Construction

Increasing Use of Machine Instead of Hand Methods Only Emphasizes Importance of Managerial Ability and Organizing Genius on the Part of Contractor—Machinery Cannot Make a Road Job

By H. D. Hammond
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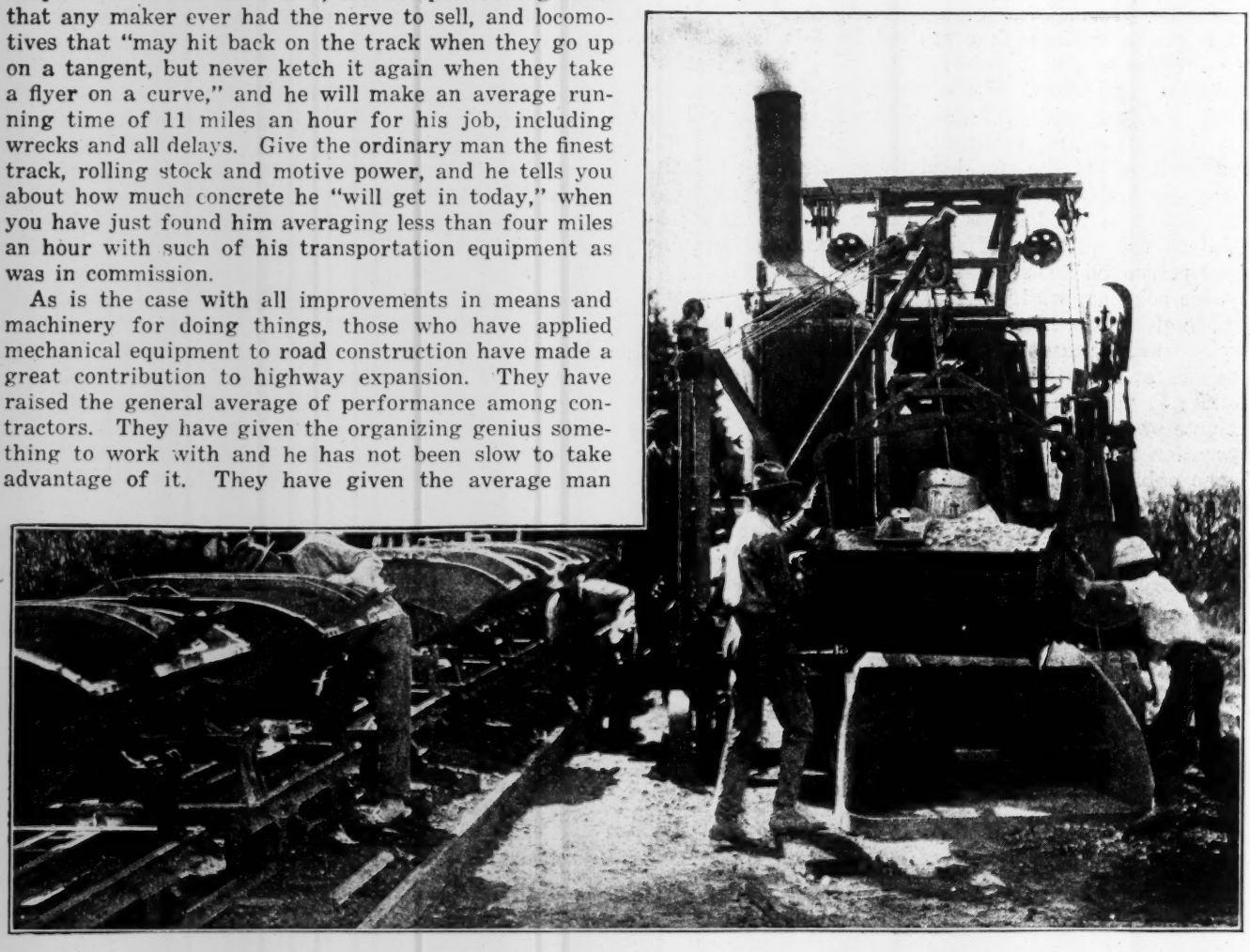
WHEN one has made a tour, such as the writer has just completed, of this season's concrete road work in the Central and Eastern states and has studied the new methods and the old side by side, one feels more strongly than ever the force of the fundamental rule of contracting—that the contractor stands or falls by his own ability. Give the organizing genius two hundred dollars' worth of wheelbarrows and a mixer, and he will break the state record for square yardage laid, even if he has to beat the time specifications of the state to do it. Give the less able organizer the finest mechanical layout in the world, coördinated to a hair, and the "minute mix" is as safe from violation on his job as the North Pole. Give the organizing genius sixteen mule teams and he manages so that he shall never run out of materials, though every other contract in the state is shut down. Give the other fellow forty thousand dollars' worth of the finest tractors and trailers to be bought, and he cannot keep a two-bag paver busy with them. Give the genius a line of inferior track, in poor shape when it hits the works, the cheapest rolling stock that any maker ever had the nerve to sell, and locomotives that "may hit back on the track when they go up on a tangent, but never ketch it again when they take a flyer on a curve," and he will make an average running time of 11 miles an hour for his job, including wrecks and all delays. Give the ordinary man the finest track, rolling stock and motive power, and he tells you about how much concrete he "will get in today," when you have just found him averaging less than four miles an hour with such of his transportation equipment as was in commission.

As is the case with all improvements in means and machinery for doing things, those who have applied mechanical equipment to road construction have made a great contribution to highway expansion. They have raised the general average of performance among contractors. They have given the organizing genius something to work with and he has not been slow to take advantage of it. They have given the average man something to think about. In addition, they have made possible a scientific accuracy and uniformity of result in the construction of concrete roads that was the despair of highway departments but a very brief while ago. The type of plant to which these observations apply is that which includes a subgrader and in which the materials are stored at a central plant and brought to the mixer over an industrial-track system.

It is nothing new to assert that subgrade which is not uniform is responsible for much failure of concrete pavement slabs. Neither is it surprising to find that one of the first efforts and one productive of the best results in the campaign to apply mechanical methods to highway work was to provide a smooth, accurate mold for the concrete, of which the forms are the side and the subgrade the bottom. This mold is made cheaply, made right in the beginning and never disturbed till the finished concrete is placed thereon. A machine with horizontal cutting knives, pulled by the tool which rolls the subgrade, riding at exact and unvarying eleva-



BATCH CHARGING WITH REMOVABLE CAR BODIES FROM INDUSTRIAL-RAILWAY SYSTEM ON ROAD SHOULDER

tion on solid steel forms, shaves the grade down a fraction at a time till it has been cut and rolled to exact elevation, and is uniform from side to side and end to end. The machine does the work at a part of the cost of hand labor. One operator and the roller man constitute the ordinary crew. Compare this with an average of several contracts where the work was being done at an expenditure of 60 man-hours for every day's run of subgrade prepared—and reflect that the machine and the roller can double this output, working part time, or going on as far ahead as the contractor cares to provide forms, and then laying off.

Look at the saving from a much more important angle. With a subgrade formed by this equipment the area of the actual pavement cross-section does not vary a quarter of one per cent. from that shown on the blueprints of the highway department. The best hand subgrade the writer found this year produced a cross-section which varied 1½% from the theoretical, and they ran all the way up to 10%, with the average nearer the top than the bottom. Of course, it is necessary that this variation shall always result in placing more concrete and never less than called for on the plans, for to average the variation would produce a succession of weak spots in the concrete. If you had contracted to put down 60,000 sq.yd. of highway concrete, rich in expensive cement, for $3 per yard, as many have, and at that price found yourself delivering $2700 to $18,000 worth of extra concrete *for nothing*, would you be interested in accurate subgrade? And remember that the fellow who escaped with the $2700 worth, so to speak, was working under antiquated specifications regarding rolling. His record had been made by filling up the low spots with loose dirt right around the mixer—a practice to which some engineers might object. The public, of course, pays in the long run for this extra concrete. Except for careless bids, it is always figured in by those who have had experience.

Aside from cost, compare the method of applying machinery with older methods. The hard, compact, accurate, uniform subgrade is there ready to receive the concrete—and does so receive it. After good money has been spent aligning a wall form and bracing it, would any engineer permit this form to be banged and knocked an inch or so out of adjustment? Yet, where materials are hauled over and placed on the subgrade, the road suffers worse treatment than this. With the new method, however, nothing is put on the subgrade, nothing travels over it or cuts it up, after it is finished, except, of course, the concrete mixer. The mixer can be, and usually is, so carried that its weight, traveling but once over the grade, scarcely leaves a mark. All this is accomplished by bringing the concrete materials up the shoulder of the road, by moving the storage area back from the road and by adopting the system of batch charging. The obvious economies in man-power of this system are well known, in theory. The superior results in terms of finished road are beginning to be appreciated. The ultimate economy of the system, then, is no longer in question. It would come, even if it involved extra payment, because the results achieved with it are worth the price. But even its immediate economy is now no longer a matter of theory. Just what is being done in terms of dollars and cents with these new methods? It is the answer to this question that the writer set out to find; some of the pertinent facts are set forth below.

IN THE TUNNEL PLAN OF HANDLING, THE MATERIAL IS UNLOADED WITH BUCKET AND LOCOMOTIVE CRANE AND ENTERS NARROW-GAGE CARS THROUGH TRAPS, WITHOUT REHANDLING

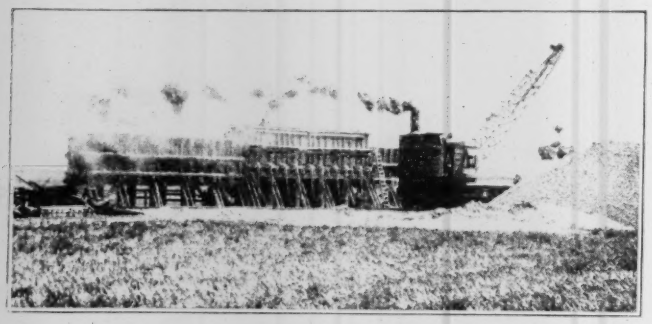
The case of the subgrader and its savings have been told. Suffice it to add that even before the concrete-finishing machine which made California famous had made its bow, the inventor of that finisher was known from Oregon to Mexico as the "subgrader king." That state no longer lays a road on which this tool has not shaped the grade.

Improvement in Central Loading Plants

The first great objection which was met in attempting to introduce central loading plants and batch transportation in the East was the cost of right-of-way for such plants and of possible right-of-way for industrial track. It is not out of place, therefore, to state that of all the work examined, the cost of such right-of-way ran from nothing, in some cases, and $5 in one, up—but not very far up. In fact, $200 a season now seems rather exorbitant for a yard site, where $2000 a season was considered conservative in estimating some of the work under way. The additional cost of constructing sidings can be furnished the prospective road builder and will be so furnished on application to the railroad concerned. Final net costs run from $1.50 to $2 per foot. This for cases where sidings of sufficient size do not exist. And, before we lose sight of the matter, inadequate siding capacity is handicapping more plants than any other one thing. As for bins, those inspected cost from $500 per car of capacity, for good bulk cement bins, down to $350 per car of capacity for very fair sand bins. Such bins rarely exceed 200-cu.yd. storage. With the tunnel plan, on the other hand, 600 cu.yd. of stored material, which would flow through the traps without rehandling, was secured on perhaps the most expensive installation in the country at a total cost of $1900—less than that of the smallest bins with which an industrial plant layout has been operated. Other installations cost as low as $1.20 per cubic yard of material that would flow, and barely 30c. per cubic yard of total storage.

Both bulk and sacked cement are being used in such installations, and of course the bulk is the cheaper and quicker to handle. It takes, for instance, 3 sec. by the stop watch for the average barrel batch of bulk cement to slip out of the scale and find a home in the batch

box, while the best efforts of three men clocked in loading sacked cement into batch cars direct from the sack was about 18 sec. per barrel. This handicap, however, is overcome by using quick-dumping boxes into which the cement is put between trains. The train slides in, and 10 or more of these boxes are discharged into it almost simultaneously. However, it is obvious that when better storage and handling methods for the use of bulk cement have been worked out (and they are



A 30-YARD SAND CAR WAS UNLOADED IN 12 MINUTES AT THIS PLANT

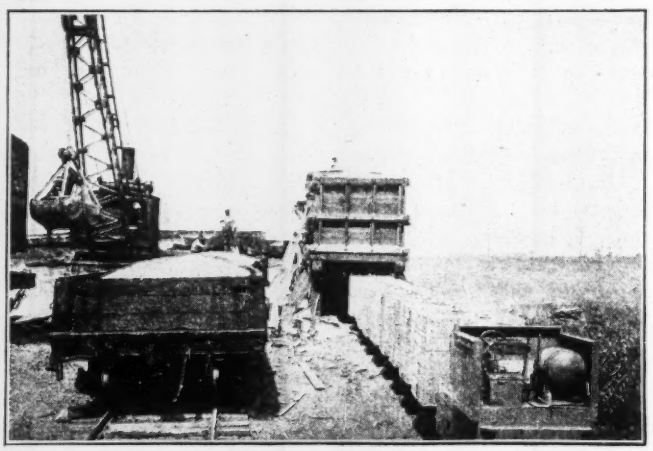
being worked out) this cheap and convenient method of shipment will come into its own on road work all over the country.

"Charging batch cars is the easiest thing we do on the average road contract," says one Eastern operator who loads 18 cars with four-bag batches in 15 min. In the Central states they are satisfied to load a batch a minute, which is considerably faster than most states will permit putting the batches into the road. However, lest suspicion be directed against the Easterner, let us hasten to add that he is running two mixing plants to capacity from one central station and getting in as high as 1600 sq.yd. of good, solid concrete in 10 hours. Another road builder near Chicago loads 15 batches in 10 min., but the batches are three-bag size. To reach this speed requires 5, 6 and 7 men, with or without the service of a locomotive to spot the trains. The preference, naturally, is to have a gate in the tunnel for every car length, so that three spots per train are sufficient. However, loading just as fast has been accomplished with two gates for each kind of material and bins, handling the cars by hand. The chief advantage of having a gate every car length thus appears to be the ability to draw all of the material off the top of tunnel by gravity. On some jobs cars are spotted by hand, some employ a hoisting engine (which adds an extra man, as does locomotive spotting, and others, again, arrange their tunnel track on a slope (6 to 9 in. to 100 ft. seems best) and spot by gravity. In addition to the car chargers, two or three men cleaning up cars, a fireman and operator for the unloading rig and a foreman are required at the average unloading plant.

Locomotive cranes or traction cranes are pronounced by the stop watch to be the fastest tools used for unloading cars. Derricks are often 100 per cent. slower, but can be made to do. It made little difference, on most jobs, whether a ¾-yd., 1-yd. or 1½-yd. bucket was used. The three sizes all take about the same load after the cream of the digging is off (which is in a surprisingly few grabs) and the larger sizes lose in speed of operation because of the restricted quarters offered by the average gondola. One operator timed was able to take advantage of the full size of a 1½-yd. bucket, and did unload a 30-yd. sand car in 12 min. and handle 18 cars in one day. It is doubtful, however, if one other runner of equal skill could be picked up today, and certainly such men are not available for the average contract.

The story is entirely different, however, when unloading from a barge. Here the bigger bucket and larger crane take full advantage of their superior power to double the rate of the smaller tools. Due, perhaps, to the inequality of operators, the best average performance of all the cranes, 12 cars per tool per 10 hours, was equalled on a single contract by each of two derricks. As to the average capacity of derricks, however, more than 10 cars per 10 hours per bucket cannot, apparently, be counted on without an unusual operator. As these plants have a transporting, mixing and placing capacity of as high as 12 cars per day per mixer, including cement, more than one plant cannot be run continuously to full capacity by one rig where the grab also handles bulk cement, unless a tunnel be sunk below ground and half the material for the job stocked during the winter. Several firms in the Central states have work on hand for which just this procedure is planned. Two rigs, however, are not out of place for the results to be achieved with the yard mixer, or the two-mixer plant using four-bag machines. We have always the possibility of finding the location in which a trestle can be built cheaply over the loading tunnel, in which case, by expressing a preference for bottom-dump cars, the contractor can triple the capacity of the single crane.

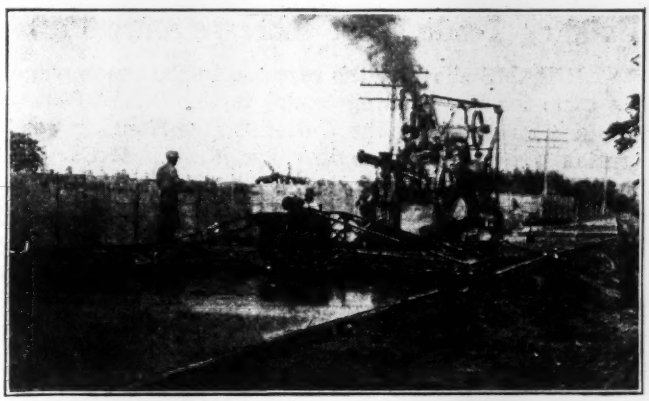
When the road contractor with railroad experience first conceived the idea of using the narrow gage for road work, he seized on the then industrial track as the only track within reach of the job from the standpoint of cost, and found it woefully inadequate from the point of view of the speed possible over it with his heavy steam dinkies. A new track was developed, better methods of laying it were found, and the gasoline locomotive was available, as well as one or more far



MAIN ITEMS OF THE EQUIPMENT EMPLOYED AT CENTRAL LOADING PLANT

superior designs of light steam dinkies. How have these factors affected train speed? As indicated in the opening paragraphs, speeds of 4 to 11 miles per hour, including all stops, have been found. Running speeds of 10 miles per hour loaded and 12 miles per hour light are easy for the locomotives and the improved track and rolling stock, while much higher speeds have been registered for short stretches. Speeds in excess of 15 miles per hour, however, are frowned upon.

As for the improved rolling stock developed, it does all that was ever hoped for it. With it, a three-ton locomotive can start a load of 36 loaded ½-yd.-batch cars. With the old brass-bearing, rigid frame cars, a Michigan contractor could pull but six units with a three-ton machine. The seventh car invariably stalled the engine. He bought some of the new cars and has added six of them to the train, making a train of six rigid-frame and six spring-draw-bar-and-pedestal cars, all



THIS ROAD WAS ENTIRELY MACHINE MADE—CONCRETE FINISHER IN FOREGROUND

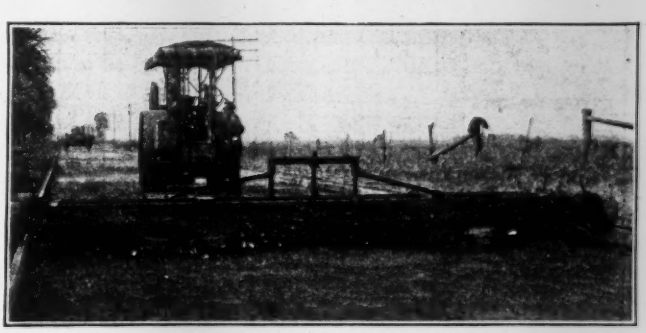
loaded, which is pulled at the same speed, over the same track, day in and day out, by the same locomtive. Rolling friction as low as 2 lb. per ton has been measured with a dynamometer in the field on such cars, while figures of 6, 8, and 10 lb. per ton are common. No reading on spring-drawbar, roller-bearing, spring-pedestal rolling stock has gone over 14 lb. per ton for fair track, and that was with inferior equipment. On the other hand, rolling friction as high as 50 lb. per ton has more than once been met with on "contractors' dump cars" of the sort universally used up to a few years ago.

The military track with pressed-steel ties applied this year to road work is winning its way with every contractor who sees it in use. It takes but 80 man-hours to lay a mile of this track in first-class condition. Of course, when poorly laid, it can be crooked, though it never exhibits the sharp kinks which cause derailment, and which were a common feature of the bolted track examined after its third or fourth laying. However, it has been found possible by some who take the bolted track apart between layings and rebuild it, to keep it in good shape. Some of the best track conditions encountered were on the first laying of such track on a job where great care had been taken. The shoulder had been first graded and rolled (a couple of hours' extra work per mile for the blade grader and roller which pay big dividends) and the track had been carefully put down. Such track, however, while it would do our road work if we had nothing better, is more expensive to lay and maintain, and with the same care can never equal the riveted pressed-tie track. For all loads contemplated, none of which exceeds 1½ tons to the wheel, the 20-lb. rail is sufficient, with six of the pressed ties per 15-ft. track section.

In the case of the type of container for the batch of concrete materials there has been a battle in the four-bag field between the batch box and the car body. In the field of the 1-yd. mixer it is likely also that preference will be divided. However, the larger car body provides a good-sized V-dump car, useful with a steam shovel on any grading operation, while the same cannot be said for the smaller body. Moreover, in the case of the smaller mixer, the batch box offers the obvious economy of carrying two to a running gear. This feature, in turn, is out of the question with the larger mixer because of excessive wheel loads. The work of this summer, therefore, has been closely watched to discover the answer to the question, "Batch box or car body?" The answer is in sight, and it has at least been demonstrated that both types of equipment have given good service. There is coming, however, a demand that the cement, irrespective of the type of container, be carried in a compartment separate from the other materials—that is, the sand and stone.

But it is on the road that the greatest saving of men occurs with such equipment. To effect this saving without a complete road plant, however, has thus far baffled those who have tried it. In using subgrade storage, picking up the materials again and putting them into the mixer, no one has yet, to the writer's knowledge, beaten the wheelbarrow game, though several have given it a good run. One job comes to mind where the contractor used three horses, 22 men and a good many thousand dollars' worth of equipment in the attempt, and succeeded only in being badly beaten as to progress by a neighbor who broke records with a couple of hundred dollars' worth of wheelbarrows and a crack gang. It must be remembered, however, that these crack gangs, and the genius which creates them, are scarce as hen's teeth, and that when such brains get hold of a modern plant the fur begins to fly. To such an organizer, capacity production with a double plant, day after day for a whole season, would be nothing.

To sum up, then, it was found that in typical cases with modern plant, nine men were on one job averaging 700, on another 860 sq.yd. per 10-hour day; 10 men had laid 1000 sq.yd. in a like period; seven men had averaged 800 and 900 sq.yd. per 10 hours respectively; and eight men had averaged 840 sq.yd. for a day of the same length, in still another case. On 5-in. base course work far higher yardages have, of course, been



WITH A MECHANICAL SUBGRADER A TRUE SURFACE IS PRODUCED, THEREBY SAVING CONCRETE

made, one Southern operator running 1675 sq.yd. in 10 hours and averaging over 1200 sq.yd. daily for a week. These examples are all taken from contracts using the machine finisher. More men on the road would be required without it. The figures all include firing and operation of the mixer, charging and discharging, spreading and finishing, but not setting forms.

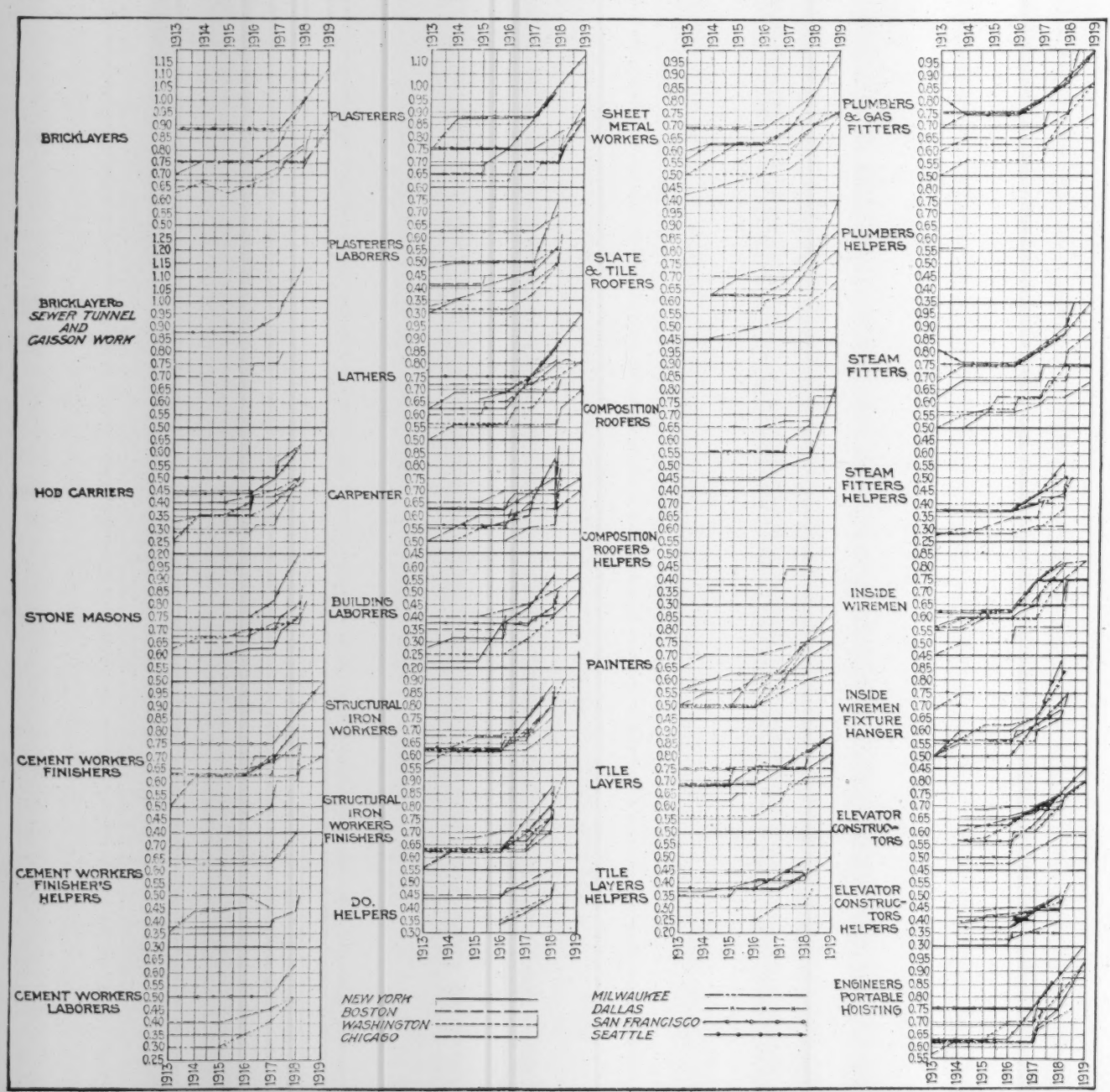
In view of the fact that, at the time of the revival of the narrow-gage haul on road construction, contrac-

tors universally estimated that with an average output of 600 sq.yd. per 10 hours per mixer, and nine men to each crew, the method would show a larger profit than wheelbarrow operation (not as carried on by the crack operators, but on a good, high average), it is evident that investment in such plant has proved more than justified. The range of figures indicates variations in managerial ability, the writer is inclined to think, rather than in local conditions. He believes that the best of them can be exceeded anywhere in the United States when the time limit of mixing each batch will permit; and that poor management may result in much lower figures.

It must be again asserted that much plant only offers some men a greater opportunity to "go broke"; and that while the highway engineer is justified in expecting and specifying, as a result of the year's developments, a class of work which could not previously be expected in actual practice, these superior results will cost for some years about what the inferior work of the past would have cost using the methods of the past under the same conditions. To the contractor, the developments of the year offer a means of doing a more stable business at a cost which, measured over a term of years, shows considerable saving, and of maintaining at the same time a reputation for doing the best work that can be done rather than an opportunity to "get rich quick."

Building Trade Wage Increase Since 1913

DIAGRAMS showing the increase in the union wage scale for the building trades in the United States have been prepared by the United States Housing Corporation from data compiled by M. A. McCarthy, librarian of the Corporation. As shown, the data include practically all of the trades and give information concerning cities in various parts of the country.



The Railway Problem—II

Public Corporations as a Solution to Secure Efficient Operation and Fair Treatment to

Labor, Capital and the Public

By CHARLES WHITING BAKER

Consulting Editor, "Engineering News-Record"

IV—Concluded from page 758

The Control of Railway Property; Theory Versus Facts

Let us squarely face the fact that the railway problem will not be solved until the control of the railways is taken away from men who gain that control for their own profit. As long as we permit anyone who can secure a majority of the proxies of the stockholders to control a railway, so long will men work for such control and make all the profit they can out of it. The most essential step toward solving the railway problem is to establish the principle that those who control the railways hereafter must exercise that control as trustees for the public welfare and not for the stockholders merely. The stockholders' interests will be taken care of any way, if rates are so fixed as to yield them a fair return.

Of course, this principle will not be established without a fight. The great fortunes have not accrued to the investors in railway stocks and bonds. They have been made by those who have exercised control over other people's property for what profit they could make; and it has been the most profitable business in the world. Those who are engaged in this business will not give it up until they are compelled to do so. They will attempt to deceive the public with the claim that any attempt to alter the present railway control is an attack on property rights. The greatest danger to property, however, arises from the attempt to identify the cause of the financiers with the cause of the owners of railway capital. The investors are willing to give up their claim on railway profits in exchange for the certainty of a fixed return. The financiers want to continue the old system of taking the risk and all the profits, because that system furnishes a foundation for the changes in value that promote speculation.

There is a defence of the "financier control" over the railways which has been widely published and which deserves fair examination. It is said that these great financiers have, after all, created the American railway system; that it was their genius and executive ability that built up this wonderfully efficient transportation machine. But was it? Is it really true that we owe to the Morgans and Vanderbilts and Goulds the development of our railways to their present stage of technical excellence? Is there any evidence to show that the financiers who control our railway systems are now a material factor in the promotion and maintenance of efficiency and of the development of better methods?

There have been, of course, in the past individual cases where the men in financial control, such as Hill and Harriman, have done important constructive work; but, broadly speaking, the credit for the excellence of American railway technique today does not belong at all to the men who have held financial control. It is the result of the patient labor of many thousands of officers of American railways in all ranks and in all branches of the service. It is the initiative and energy of these men and of thousands of others in the kindred industry of railway supplies which have developed the railway from its small beginning nearly a century ago to its present status. It is these railway officers today on whom we must rely for preserving what has been gained in the past and going forward to the achievements of the future.

Is it necessary to continue eminent financiers in control of the railways in order to insure their efficient operation? These eminent financiers might all be given a year's leave of absence at once, and railway operations would not be impeded for an hour. If, however, all the officers of all the railways in the United States were tomorrow to quit their jobs permanently, it would be a public calamity whose effects would be felt for many years.

So far is it from being the case that "financier control" of the railways is necessary for efficient operation, that in railway official circles it has long been recognized as a disaster to have the control of a railway property pass into hands which will, as the saying is, "operate it from Wall Street."

And now, bearing clearly in mind the facts just presented, let us stand off and take a bird's-eye view of the railway situation. We have allowed railway operation to be carried on as a private business at the risk and for the profit of its owners. We have allowed the control of that business to be made a source of private profit by whoever was able by any means whatever to secure such control.

What we need to do—surely all will agree—is to establish the principle that the men in control of the railways shall act as trustees. They should reap no pecuniary benefit from their trust and should administer the property not to earn the largest profit but to render the largest public service at the lowest cost.

It may be said that some railways are now managed with just such honesty and recognition of public obligations; but we have no assurance of it so long as law and custom permit corporation control to be secured for the direct purpose of making a profit.

V.

The Danger in Too Centralized Control

There will be general agreement, surely, that an acceptable solution of the railway problem must not destroy valuable property of the railway companies. There is one very valuable asset of the railways which some of the plans that have been proposed would injure seriously. We refer to *the operating organizations.*

A railway is not merely so many cubic yards of excavation and embankment, so many miles of rails, so many locomotives and cars. It is an organization of men who have had years of training and experience in using the track and equipment to carry on, systematically and economically, with discipline and team work, the business of transportation. These organizations have been built up by years of painstaking, conscientious, loyal effort on the part of thousands of men—managers, superintendents, engineers, foremen. These men know one another and are accustomed to working with one another.

No question is raised here as to whether this great asset should be included as one of the elements in railway valuation. On that question there may be difference of opinion; but there can be no question that in any necessary reorganization of the country's railway system great care should be taken to preserve this asset. Changes which may affect it should be gradual and not sudden.

The experience of the past two years has shed an important light on this matter. There is a general public impression that we have been making an actual trial of Government railway operation since the beginning of 1917 and that the results have been disastrous. But this is very far from being the true state of affairs. We have not really tried Government operation at all. When the Government took control of the railways it continued the entire operating organization of each corporation. If it had not done this, if it had attempted to discharge all the officers and employees of every road and start operations anew with an entirely new force complete chaos would have resulted.

The really grave difficulties which have developed where Government operation of railways has been adopted as a permanent policy—partisan political interference in the selection of officers and employees, delays in operation due to Governmental red tape, conflicts between departments, and so on through a long list—we have not experienced.

And yet it is true that the short experience with Federal control has already exhibited one of the essential defects of Government railway operation—undue centralization. In *Engineering News-Record* of Sept. 4, 1919, p. 457, and Sept. 25, 1919, p. 615, a railway executive officer has well set forth some of the ways in which the attempt to establish central control has injured the service and increased the cost of operation.

Of course, there had to be a central control over certain matters. In the war emergency the railways of the country had to be operated as a single system, and it was that necessity that compelled Federal control. But the extension of central control to an unnecessary extent, the emphasis laid on the absolute authority of Director General McAdoo—who can measure the influence this had in paralyzing the energy and initiative of thousands of railway officers in all branches of the service? It is these officers on whom we must rely for safe and economical operation of our railways, and we must preserve in every possible way the conditions that inspire these men to energetic and faithful service.

These men are almost without exception opposed to any sweeping consolidation of the railways. They have a pride in the existing organization of which they are a part. They labor diligently in its interest with a zest and spirit impossible to maintain were they merged in a single, vast organization. They see in any wholesale consolidation the complete disappearance of the individual. There would no longer be the chance for a man who proved his ability and worth on one road to find opportunity on another road. Competition among different railways for the services of valuable men would be at an end.

The public is right, therefore, in its demand that competition among the different railways shall be re-established. This does not mean that there will again be material competition in rates. Present-day conditions forbid that. It means that the operating organizations of the Pennsylvania R.R., for example, will take pride in their work in comparison with that of other roads in the same territory. And this has really long been the mainspring of progress in our railway operations. The railway officer does not put his best energy into "playing the game" because of any benefit to himself from increased earnings. It is not fear of discharge or hope of promotion that incites him to work long hours and strive to better records. It is the same incentive to "play the game" that energizes the men of a football team.

There is a general belief that Federal control of railways has worked badly. This is partly based on the poor financial showing, for which, as was shown in the first chapter, Federal control should not be unduly blamed. The other respects in which Federal control has not worked well will be found on analysis to be generally traceable to the unnecessary centralization of control and the accompanying discouragement of the individual railway officer. Thus, the brief experience in Federal control has furnished an object lesson which should certainly be heeded. We need efficiency and energy and ambition in the conduct of this vast transportation business. These are plants which will not grow in obedience to a fiat from the top.

The great railway corporations long ago found out that a system several thousand miles in extent could not be efficiently operated from a single headquarters. Much more is this true of the nation's railway system covering a continent 3000 miles in width.

Any project for consolidating all the railways of the country into a single corporation is therefore inherently defective. The judgment of railway executives coincides with this. Judge Lovett, president of the Union Pacific, in his pamphlet on "The Railroad Problem," says:

> My judgment is against the consolidation of all the railroads of the country into a few companies, say from 10 to 30, because I believe the companies would be too large and unwieldy for efficient and economical management. I believe railroad executives generally will agree that railroad systems may be made too big and that there are limits beyond which a railroad system should not in the interest of economy and efficiency be extended. . . . I believe the existing railroad systems should be taken as a basis and such consolidation as is desirable should be built up on that basis.

The evils of undue centralization in operating control apply also to measures proposed for Government control. Necessary though it has been demonstrated to be that a single Federal control be established to supersede, or at least be superior to, the control by the separate states,

the facts brought out in the hearings at Washington have made it evident that no single board at Washington, whether it be the Interstate Commerce Commission or any other body, can exercise that detailed supervision of railway operation which all agree to be necessary in the future. With all it has been able to do in delegating its powers, the Interstate Commerce Commission is overloaded with work almost to the breaking point. It is a year behind with its decisions. It is self-evident that any body which is to supervise railway operations effectively must be so organized as to be able to act promptly; but an event which happens a thousand miles away cannot possibly be intelligently handled from Washington without long delays.

VI.

Public Corporations To Replace Private Corporations

On the basis of the facts recited in the previous chapters, it becomes possible to lay down the general principles on which an acceptable solution of the railway problem must be based. The existing state corporations must be succeeded by Federal corporations, as the Cummins Bill now before Congress provides. These corporations must be conducted not with the object of making all the profit possible for the stockholders or of yielding any benefit whatever to financiers in control. The purpose of these corporations must be to carry on the transportation business in the most efficient manner at the lowest cost. Rates must be so fixed that there will be in the long run a fair return to the owners of the road on their invested capital. Profits above this fair return may be divided among the stockholders, the employees and officers, and the public. There is general approval of the proposition that part of the excess profits may well be distributed among the employees as a premium on efficient and faithful service, but there is general dissent from the idea that the employees are entitled to all the surplus profits, as if they owned the roads. Even the Plumb plan does not propose this.

The Cummins Bill provides that rates shall be so fixed as to return as nearly as may be 5½% on the value of the property. Where a company earns over 6%, it may retain one third of the excess over 6% for itself and must pay the remaining two-thirds to the Federal Transportation Board, which is to use it for the public benefit in improving railway transportation.

The National Railway Conference plan allots one-third only of the excess profits to the stockholders. The remainder, after provision is made for insuring against deficits in operation, reverts to the public. In this plan some risk is left to the railway investor, so that giving him some share in surplus profits earned is equitable. It is noteworthy that this plan, which represents the best thought and study of a group of eminent financiers, business men and economists, practically accepts the principles above set forth, and discards entirely the present theory of the law that a railway is a private business whose owners have an absolute title to all the profits they can make.

How shall the directors who are to conduct these reorganized public corporations be selected? The Cummins Bill provides for the appointment of two directors selected from the classified employees, while two are to be appointed directly by the Railway Board, a Federal body vested with complete supervision over all railway activities. On every important committee of the board there must be one employee director and one board director. The Lenroot Bill provides for the organization of a National Railroad Corporation, with 11 directors appointed by the President of the United States from nominations made as follows: One from the Interstate Commerce Commission, one from the State Railway Commission, two from railway employees, two proposed by the Chamber of Commerce of the United States, two by agricultural organizations and three by the stockholders, voting by letter ballot and not by proxy. The National Transportation Conference proposes Federal corporations with 12 directors, one chosen by the employees and three by the Federal Railway Board.

It will be seen from these plans and others which might be cited that the principle is already generally accepted that there is no infringement whatever on property rights in placing the power to select directors elsewhere than in the hands of the stockholders. Further than this, if the principle is accepted that the stockholder is entitled to a fair return on his investment anyway, he is no longer the chief party in interest in the efficient conduct of the property. It is the general public which must pay the bill if the railway in which the stockholder has an interest is badly run. The railway employees, too, have a direct interest in the safe and efficient operation of the road. It is the business in which they earn their living. Their lives and limbs as well as their daily bread are at risk if the road is badly managed. There is therefore nothing inequitable in giving both the public and the employees a voice in the selection of directors.

Even if the old basis, where the stockholder bears all the risk and takes all the profits, were to be re-established, the stockholder will stand to gain rather than lose if some intelligent plan of selecting directors can replace the present plan. Is there any body of electors more helpless to exercise intelligent choice than the stockholders of a great corporation? They may be ten thousand or a hundred thousand in number, scattered all over the United States. A stockholder has not even the legal right to know who his fellows are. The voters of a city ward at least live in one locality. The members of a trade union know one another by association in the same occupation. Either body is better able to select intelligently men of ability and honesty for positions of trust than are the stockholders of a big corporation.

The importance of a right selection of directors can hardly be overestimated; for if corporations for public service are to supersede corporations for private profit, the director's office will be one of great responsibility. The rubber-stamp type of director will not do. If we are really going to displace the financier from the control of our railway systems we must put someone else in his place. It will be "up to" the directors to formulate and decide questions of general policy, finance, relations with the public, etc., questions that have hitherto been settled in bankers' parlors.

Herein, indeed, lies the greatest hope for the better development of our transportation system. Suppose the directors of a great railway were men with a broad grasp of the larger problems of transportation. Suppose the position were one to which executive officers of the road might aspire as the final step in promotion. Suppose the policy of the railway were studied with the public interest clearly in mind and with the motive of private profit for a group in control wiped out. It would open a new era in railway development.

It is that ideal toward which intelligent and unsel-

fish students of the railway problem are really striving. The Lenroot Bill provides a salary of $20,000 for the directors in its proposed National Railway Corporation. The Esch Bill, amending the Interstate Commerce law, provides that a director can hold office in only one corporation and must not benefit directly or indirectly from the corporation's financing. There is no public defense anywhere of the use of company control for the profit of financiers.

Where can the responsibility for the selection of directors be placed with the greatest likelihood of having men chosen of the requisite ability and fidelity? The body of men best capable of making an intelligent selection are the officers of the railways; and the Plumb plan gives them the choice of one-third of the directors. This excellent feature is overbalanced in the public mind by the fact that with another third of the directors chosen by the employees a majority of the board would represent those whose interest lies in high wages and salaries, and the public might be made to pay excessive transportation rates for the benefit of railway workers. The employees and officers may properly be given a voice in the choice of directors; but they should not name a majority.

Various plans propose that directors to represent the public shall be appointed by the President of the United States. The fear here is that politics might control in the selection or the directorships might become asylums for Congressional "lame ducks." The Cummins Bill and the Conference plan both provide for the appointment of public directors by the Federal Railway Board, responsible for the supervision of railway operations. No better plan has been anywhere proposed. There is no reason why it should not be possible to secure for the Federal Transportation Board men of as incorruptible quality as those who have served on the Interstate Commerce Commission in the 30 years since its establishment.

There are other causes besides the different manner of selection which will operate to place the office of director on an entirely different plane. The financier who spends his good money in obtaining control of a railway property easily squares with his conscience his use of that control to bring business to his banking firm or to the industrial concern in which he has an interest. The very same man appointed as a public trustee would feel an entirely different attitude toward the property.

And there will not be the same temptations for directors. With railway stocks yielding a substantially fixed rate of dividend, their market price will suffer little variation; the mainspring of speculation will be taken away; and with it will go the director's temptation to profit by his inside knowledge. Again, in the passing upon large purchases, or the acquirement or transfer of a subsidiary corporation, it was easy for the financiers in control to cover up irregularities when directors acted as a rubber stamp; but with a dozen men on a board of directors exercising actual responsibility and devoting most or all of their time to the work, it will require a conspiracy of the entire board to carry out a dishonest act.

Certain eminent financiers have recently declared that the re-establishment of railway credit is the heart of the railway problem. This is true if we are to go back to the methods of the past; and yet a return to these methods would make the railway problem practically unsolvable. Railway bonds and notes are continually falling due, and the holders who have been getting 3½ to 5 per cent. will only renew for 7 to 8 per cent. or more. New capital required in large amounts is even more costly. If we allow this condition to continue only a little while, the payments on railway capital will rise so high as to arouse public protest. It will make more serious the very risk that now deters capital from railway investments and will aid those who are seeking to destroy all property rights.

Suppose, however, that public corporations operated by trustees are to supersede the present private corporations and that rates are to be fixed to yield a moderate but certain return to the stockholders. Railway investments would be transferred to the same class as Government bonds so far as safety is concerned. It would no longer be necessary to finance railway requirements with short-term notes sold by bankers for high commissions. That pump which has proved so serviceable in producing a repeated flow from the railway treasuries to the bankers' coffers would be put out of business.

With the railways thus conducted, moreover, it will be possible gradually to amortize railway capital. Rates should be so fixed as to provide an ample margin of earnings over that required for regular returns on capital, and a large part of this margin should be used to furnish the capital required for new construction and to retire existing bonds and notes falling due. With the railways operated for public benefit, there will no longer be a motive for starting big enterprises in order that the interests in control may reap some profit.

With the railways of the country operated on these principles, every year should see a decrease in the amount of railway capital outstanding and in the proportion of railway earnings required to pay a return on capital. And it is in this direction that progress lies. The public should not be forever obligated to pay the interest on money spent a half century or more ago. These debts should be paid off from the surplus earnings. These surplus earnings are contributed by the public, and the property thus paid for will thereafter be public property like the highways. There is no injustice to property rights in such a policy; on the contrary, it safeguards them. The public is willing to pay for the use of the live capital in the railway machine; but a limit must somewhere be placed to the accumulation of dead investment upon which an interest charge must be paid.

If anyone objects to this policy, let him face squarely the opposite alternative. Railway capitalization has been rolling up like a snowball in recent years, and so have the returns to railway owners. Holders of railway capital received $393,000,000 in 1900. In 1917 they received $857,000,000. Our hope for social progress and for averting revolutionary attacks on property lies in amortizing railway capital instead of enormously increasing it.

VII.

How May the Change From Private to Public Corporations Be Effected?

There will be general agreement among all well informed students of the railway problem that realization of the ideal here set forth—to have the railways of the country directed by men of ability and integrity, with the aim of conducting the transportation business in the most efficient and economical manner—would open a new era in railway development.

But to effect the transformation from the present organizations is a task full of difficulties. Many of the plans proposed at Washington contemplate the consoli-

dation of the railways either into a single, vast corporation or into a number of large, "regional" corporations. The Cummins Bill requires the formation of "not less than 20 or more than 35 distinct systems, so planned as to preserve competition, yet effect a uniform cost of transportation and earn the same percentage of returns when operated under the same rates!"

But nobody is wise enough to know now to what extent these results *can* be obtained by consolidation. Nobody is wise enough to determine now to what extent consolidation will promote efficiency in operation. For the reasons set forth in the preceding Chapter V (as well as for many others which lack of space forbids presenting here) any changes in the present operating organizations should be made only after their advantages have been positively determined by long and thorough expert study.

Any huge, hastily planned consolidations, even were they eventually beneficial would make shipwreck of the railway transportation machine during the transition period. Further than this, the railway problem demands *a prompt solution.* The only safe and practical plan, therefore, is to deal first with the existing railway corporations. Let these be transformed from private to public corporations first. It will then become one of the tasks of the directors who conduct them to ascertain, by thorough investigation, where consolidation will be advantageous. That problem can be dealt with far more intelligently by the directors of these individual corporations, familiar with the practical operating conditions in their own part of the country, than by a Federal board in Washington.

In the second place, it is extremely desirable that the reorganization from private to public corporations here proposed shall be done as *a voluntary act* by the present railway corporations. If Congress attempts to *compel* state corporations to reincorporate as Federal corporations, protracted litigation is certain. The old question of state vs. Federal authority would introduce bitter political controversy. If it were attempted to force consolidations, as the Cummins Bill proposes, by condemning railway properties, there would be litigation, over the determination of values, that would tie up the whole reorganization plan for years. The same thing would be true of any of the plans which propose the taking over of the railways by the Government. The Plumb plan, for example, would throw the entire burden of appraisal of the railways on the courts and would produce so vast an amount of litigation as would absolutely block the wheels of justice.

If, then, any plan can be devised under which the present railway corporations will *voluntarily* reorganize as public corporations under Federal authority, it will be vastly easier to put into operation than any compulsory plan. Furthermore, it will obviate the very real danger that if the settlement of the railway problem is left to long-drawn-out court proceedings, public impatience with the courts will pass all bounds, and the forces that make for anarchy and would destroy courts and all other authority will be strengthened.

Of the numerous plans for determining what is a fair return to the owners of railway capital, presented befor the House Committee on Interstate and Foreign Commerce, that of Mr. Victor Morawetz, chairman of the board of directors of the Atchison, Topeka & Santa Fe Ry. (published on pp. 522 to 532 of the printed reports of the hearings) comes nearest to meeting the conditions above set forth. The plan here presented is closely similar in principle to that of Mr. Morawetz in a number of its features.

Mr. Morawetz demonstrates more fully than space here permits that the declaration that railway owners are entitled to a fair return on the fair value of their property "furnishes no standard whatever for establishing just rates." The "value" of a railway is not the money which was originally expended in its construction plus later additions to the investment. It is impossible to determine today how much the original expenditure was. Even if it could be determined, it would form no fair basis for taking over the railway property or fixing rates. Billions of dollars have been spent on railways which are not and never can be profitable.

Neither does the present cost of reproducing the physical property of a railway give any fair basis for determining its value. The cost of reproducing the railway system of the United States at the prices of labor and material now prevailing would be at least 50 per cent. greater than the total of all railway stocks and bonds outstanding. Besides this, the value of a railway, or of any other piece of property, may be very little compared with what it cost originally to build or with what it would cost to reproduce it now.

It has been proposed that the railway companies' property investment accounts shall be taken as the basis on which they are entitled to a fair return; but this would tax the public for returns on thousands of miles of moribund railway properties which can barely earn their operating expenses.

Mr. Morawetz concludes that there is no possible basis fairer to both the public and railway owners for determining the value of the railways than their past net earnings, averaged over a series of years. He proposes the three years prior to Federal control, which is the present basis on which the Government rental is fixed. Mr. Morawetz provides also for adjustment in certain cases where the net earnings may have been abnormally high or low.

The criticism has been made, however, that in these three years the net earnings of the railways averaged greater by nearly 40 per cent. than the average of any three years preceding. To meet this criticism, it would be fair to take the average of a seven-year period for the standard rate of return, and add to this, for each individual road, interest on money actually invested in extensions and improvements since the average was taken.

One of the greatest difficulties with which those who are trying to solve the railway problem are wrestling is to equalize the income of the weak roads and the strong roads. Judge Lovett and Justice Hughes declare that by no possible subterfuge can the Government take away part of the earnings of the strong roads and give them to the weak roads. Elihu Root and other eminent constitutional lawyers take the opposite view. This disagreement means at best a long fight in the courts if by process of law it is attempted to force an equalization of income between weak and strong roads.

But while there is doubt as to the power of Congress to *compel*, there is no question as to the power to *permit*. Congress can *permit* any carrier of interstate commerce now incorporated under a state law, to reincorporate under a Federal law. There may well be doubt of the power of Congress to take part of the earnings of a prosperous railway and give it to a struggling rival; but Congress can charter a Federal Guarantee Corporation which can guarantee to railway corporations which are reorganized under Federal law a certain rate of return on their capital, and if the corporations voluntarily accept such a guarantee there will be no need of a resort to the courts.

The plan by which these principles may be carried into effect is as follows:

To every railway corporation engaged in interstate commerce is offered the privilege of reincorporating as a *Federal corporation for public service*, with the declared object of carrying on the business of railway transportation with greatest efficiency and economy, under the general regulations of the Federal Railway Board. The corporation is to be conducted by directors of three classes: One class will be nominated by the stockholders of the corporation; one class nominated by its organized employees and officers, and a third class, representing the public, will be nominated by organized commercial, financial or agricultural associations, or Governors of states, or state public service commissions, in the territory served by the company's roads.

These nominations are all to be made to the Federal Railway Board, by which the final appointments will be made. These directors are to be men of experience and ability in the administration of business affairs and are to receive adequate compensation.

That *nomination* instead of final selection should be made by the groups of stockholders, employees and public organizations, is believed to be very important. It would be incumbent on the group presenting a candidate to show that he was fitted by experience and character for the responsibility he was to undertake. Under this plan any organized group of employees could offer candidates. The locomotive engineers might offer one man, the conductors another, the shop employees another. So candidates representing local interests might be offered by Governors of states, by organizations of shippers, by chambers of commerce, etc. The Federal board would have before it lists of candidates with their qualifications, and could select those best fitted to render service. The Federal board should have authority to make other selections for the class of directors representing the public than those nominated by public bodies and public officials in the territory served by the road. On the other hand, for the directors representing the operating force and those representing the stockholders, the board's selection might be confined to the candidates nominated, in order that both employees and stockholders might be assured of representation by candidates of their own choosing.

There will be created also a Federal Guarantee Corporation under the management of the Federal Railway Board. Every railway corporation reorganizing as a Fderal public-service corporation will enter into contract with the Federal Guarantee Corporation; under this contract it will turn over to the corporation its net earnings and will receive from the corporation its "standard adjusted return," being the average net earnings which it made for the seven years from 1911 to 1917, inclusive, plus interest on the money actually invested in its property as "live capital" since the middle of the test period.

Of course, agreement will have to be reached as to what is a fair rate of interest to allow on this additional investment. After the plan above set forth is put into effect, however, there need be no further controversy over what is a fair rate of return on the new railway capital hereafter required. Each company will issue, under the authority of the Federal Railway Board, such new securities as its needs require, will sell them to the highest bidder, just as cities do their bond issues, and the interest on this added capital, whatever it may be, will be added to the company's standard guaranteed return.

On the other hand, the surplus earnings of the railways, after operating expenses and the standard guaranteed return on capital are paid, will be available toward the need for new capital. The Federal board will use this surplus either to invest in the new securities or to retire outstanding issues, whichever will effect the greatest reduction in the guaranteed return to capital.

It will be to the interest of the present railway corporations to enter into the above-described agreement and accept the guarantee. They will receive the advantage of Federal incorporation. They will have a certain return, through good years and bad years. They will be freed from the risk of depreciation of their investment by demands of labor, by restrictions of Federal or state laws, and by the manipulations of financiers. These considerations should be sufficient to bring in even the corporations which are making the best earnings under present conditions and have the best prospect of future increases in earnings. The weaker corporations will, of course, be very glad to come in.

The Federal Guarantee Corporation, which should be started in business by Congress with a revolving fund of, say, $500,000,000, should be able to restore this sum to the Treasury in no long time, for rates should be so controlled by the Interstate Commerce Commission (or other Government rate authority) that the net earnings of the railways in each section of the country would meet the operating expenses plus the standard return, and leave a good margin besides.

To provide an additional incentive for efficient operation, a certain percentage (say 30 per cent.) of the amount by which the net earnings of any road exceed its standard rate of return should be distributed annually as a profit-sharing dividend to all regular employees and officers of the road in proportion to their respective wages and salaries, the officers, however, on whom efficiency chiefly depends, sharing at double the rate of the employees, as the Plumb Bill proposes. The remaining margin will be added to the revolving fund, and this increment would be available toward supplying the needs of the several companies for additional capital, as explained in a preceding chapter.

This will be a far more effective stimulus to efficient service than that offered by the Plumb plan, which lumps all the employees of all railways together. This annual "bonus" will interest the men and officers of a particular road as does the prize in an athletic contest. It will be an index of the extent to which the operating force of that particular road has made good in comparison with men on other roads. It will very likely effect enough saving in increased efficiency to more than offset the payments made to the men. And such saving as is made will revert to the public, not to railway stockholders.

To eliminate eventually the complicated financial structure by which most railway corporations have been built up, it should be provided that in reincorporating as a Federal corporation the old company agrees to sell all its property to the new Federal corporation, or to any other similarly organized Federal corporation, for a sum proportionate to the adjusted operating income or standard return of the company in the past, as defined above, and to accept the securities of the new company in payment therefor.

This would provide a foundation on which to effect consolidations, where consolidations are later found to be advantageous, on an equitable basis without resort to the courts, without bargaining, which might result in detriment to security holders of some of the companies affected, and without heavy commissions to financiers.

The criticism may be made of the above plan that it

gives stockholders the right to make nominations for directors, whereas, as has been demonstrated in the preceding chapters, stockholders as a class are so incapable of intelligently selecting directors that the selection has gravitated to the hands of financiers.

In framing the above plan, however, it has been deemed wise to take the conservative rather than the radical view, to change nothing that it is not absolutely necessary to change, and to defer so far as possible to existing prejudices. We have to recognize that the financiers of the country have for years been in control of the railways. If any group of them, holders of railway stock, can recommend to the Federal Railway Board a man with the ability to be a real railway director and can show that he would use that ability with the same fidelity as he would the trusteeship of a university, they might give valuable aid in solving the big problem in which the welfare of all of us—bankers and business men and laborers and all—is bound up.

We must all recognize, too, that the great need is a policy on which all can agree. The business community may find it easier to accept a plan which still leaves stockholders some voice in the selection of the men who are to control the operation of the roads.

For a similar reason it may be the part of wisdom to permit the stockholders of a reorganized company to have some share of the profits earned by it in excess of its standard returns. For example, the Federal Guarantee Corporation might guarantee to a railway 80 per cent. of its "standard adjusted return" for 80 per cent. of its actual net earnings. Thus, suppose a railway company's standard adjusted return were $1,000,000 and its actual net earnings in the year 1921 were $1,200,000. The company would retain 20 per cent. of the latter sum ($240,000) and pay 80 per cent., or $960,000, to the Federal Guarantee Corporation, receiving in return the guaranteed sum of $800,000, or a total amount of $1,040,000 to distribute among its security holders. This provision would furnish an added incentive for the stronger roads to accept the plan voluntarily.

Let it be said frankly that this feature is proposed here not to defend it as logical or equitable, but as a concession that it may be necessary to make to the natural prejudice in favor of past methods and customs. If this concession is necessary to secure the acceptance by the business community of the constructive plan here presented, it will be worth making.

And now the question may again be raised, Would the present railway corporations voluntarily accept such a plan?

In order to have it accepted, the decision upon it should be made by the actual owners of the road, the stockholders, and not by the financiers in control whose interest lies in the perpetuation of past conditions. That holders of railway bonds and stocks are willing to accept a fixed rate of return in lieu of carrying the risk for the chances of excess profits is evidenced by the fact that this principle has been formally accepted by the National Association of Owners of Railroad Securities, representing an investment of nearly $9,000,000,000.

Assuming that the decision lies with the security holders, it is obvious that the plan would certainly be accepted by all the companies whose financial returns are now unsatisfactory. Even the companies whose finances are in fair shape would find the majority of their security holders glad to be freed of the risk from threats of labor troubles, rate restrictions and Wall Street manipulators, and would be glad to be assured a fixed rate of return.

The only companies concerning which a question would arise would be a very few which have prospects of future earnings largely in excess of those during the period from 1910 to 1917. Even such a company, however, could not well afford to stay out and remain a state corporation. If a company did so, it would be subject in the future to such state legislation as the full-crew laws and the other onerous and costly state restrictions that are increasing in number all the time. Immediately on the return of the roads to their owners, such state-fixed rates as the two-cent a mile local passenger fares will be re-established. Imagine also the position of a company which continued to carry on its business with the avowed object of earning profits for the owners when other railroads in the same locality were operated to render public service, were rewarding their operating force with a share in the profits, while the balance of their excess profits was being returned to the public by retirement of the invested capital.

It will be evident that a railway corporation attempting to carry on its business in the old way would find itself in an unenviable position with shippers, with the public and with its own officers and employees. And if a railway company did survive all these vicissitudes and make earnings in excess of those which it would have received as a Federal corporation entitled to its standard return, would the stockholders feel sure that this excess would be distributed to them and not absorbed by those in control of the property?

Also, the question will inevitably and properly be raised whether under this plan the railways would be conducted with as great efficiency and economy as under the present corporations, where the transportation business is carried on for profit.

In the preceding discussion it has been explained how fallacious is the common belief that the desire of the railway owners for dividends is the underlying cause of economical railway operation. Interesting additional testimony on this point was given by the Hon. George W. Anderson, a former interstate commerce commissioner, before the Esch committee, on Aug. 27, 1919. Mr. Anderson said:

"I regard capitalistic management of the railways as we have had it in the past as a failure. I do not think there is any effective initiative in any of the big railroad companies today, nor has there been for 20 years. The offer of a share in the management and a share in profits promises an improvement over the state in which employees have long been, and should improve the morale and efficiency."

In answer to the question whether the railroads would come under political influence if part of the directors were Government appointees, he answered:

"I think that an organization of this kind will be less political and more responsive to sound principles than the accidental financial cliques called railroad corporations which have managed this business during recent years. They have given us neither economy, efficiency, progress nor just and proper care of the rights of their investors."

There may be difference of opinion as to whether Mr. Anderson overstates the deterioration in morale among railway officers and employees; but it is absolutely certain that the railway officers as a class have been seriously disheartened by their experiences under Federal control, and that projects for wholesale consolidation which will reduce them further to the status of mere cogs in a huge machine will inevitably drive into other occupations a large proportion of the men with greatest energy, initiative and ambition.

If, however, there is promise that the railways may

be relieved of Wall Street control and may be administered by men who understand the transportation business, railway officers from top to bottom will have better assurance that ability and merit will win promotion and fair compensation than they have had for many years.

VIII.
Federal Railway Control, Past and Future

A very easy way for Congress to solve the railway problem would be to "pass the buck" to the Interstate Commerce Commission. Congress has had that habit for many years now. Every time a new measure for regulating the railways has been brought forward, Congress has tossed the matter over to the Interstate Commerce Commission. Not a question has been raised as to whether that body was not already overloaded with responsibilities, or as to whether its organization and methods fitted it for the job. There is no statute limiting the load which can be placed on an executive officer. There is a law of nature, however, which decrees that the overloaded man will either fall under his burden or else shove some of it off.

The Interstate Commerce Commission has struggled manfully to keep from being submerged by increasing duties; but in spite of all it has been able to do in delegating its responsibilities, it is far behind in its work, as is well known. Cases brought before it require a year to reach a decision. Further than this, the commission's organization and methods are those of a court, not an executive body. It cannot possibly do the sort of work in Government control that the present necessity demands.

Hitherto Government railway regulation has consisted chiefly of "thou shalt not" laws. Repression and punishment have been the chief aim. The time has come when this will no longer suffice. For example, laws are on the statute book to prohibit railway construction, or the issue of railway capital, until the necessity is proved. It never occurred to the lawmakers that public necessity might demand new railway construction or the issue of new capital, and no one would come forward with an offer to supply the necessity.

Railway transportation is a public necessity. If private capital will no longer take the initiative in furnishing it, then the Government must. There must be some Government body with the power and authority *to get things done*—not merely, like the Interstate Commerce Commission, to stop the doing of wrong things.

Both the Cummins Bill and the National Transportation Conference plan provide a Federal Transportation Board, with complete authority over the operation of the country's railways. The success of such a board will turn on the question whether a reorganization of the railways for public service instead of private profit can be effected. If the railways are transformed to organizations for public service on the lines laid down in Chapter VI, it will be comparatively easy to effect a central Federal control and co-ordination of railway activities.

Under these conditions the different railway companies will be working in harmony with the Federal board. They will have no object to do otherwise. On the other hand, if we go back to the conditions of the past and have a thousand railway corporations working for private profit and a little group of five men trying to enforce certain statutes that run counter to that profit, antagonism is certain.

For reasons already set forth, we cannot go back to the old conditions. Unregulated exploitation of the public by the railway companies will never again be tolerated. It has become impossible to finance private railway companies under public regulation to the extent now necessary. The only alternative, therefore, to outright Government ownership and operation, with all its inevitable inefficiency and waste, is the establishment of public corporations on the lines above laid down.

A Federal Transportation Board to co-ordinate and direct the operations of such companies is absolutely essential. Upon its ability and fidelity would depend to a very large extent future progress in the art of transportation.

The selection of the directors to represent the public by the board, will be a task of the highest importance. These men will have a power such as has seldom been wielded. Upon the board will devolve the task, in all probability, of working out the details of the new plan of carrying on the country's transportation, with the aid, of course, of the best expert advice that can be secured. The Cummins Bill provides a salary of $12,000 a year for the members of this board; but what is needed is not $12,000 men but $50,000 or $100,000 men. Let their salaries be such as to relieve them from all temptation to make use of their enormous power, directly or indirectly, for their own profit.

How would such a system of public companies under public control work in comparison with past methods? Space permits a single illustration. It is agreed that consolidation ought to be undertaken on a large scale. The day of the little railway corporation has passed. Heretofore railway consolidation has been carried on solely to make profits, and not always the profit of the stockholders concerned, by any means. There has been no more effective machine for transferring money from the stockholders to the financiers in control than the buying and selling of roads.

The existing railway systems have not been planned with a view to economical operation and efficient public service. They have grown by bargain and sale. There is general agreement that these systems must be radically altered and rearranged, to facilitate economical operation. If we leave the railways in the hands of corporations operated for private profit, with the gate wide open for the diversion of that profit to the benefit of the interests in control, there will be all sorts of schemes for the spoliation of investors, and probably a huge addition to the bulk of railway capital. Both the Cummins Bill and the Conference plan foresee this, and clothe the Federal board with full authority over such consolidation.

That task will be difficult at best; but it will be vastly easier if the railway corporation management is first transformed, on the principles herein proposed, for those in control of the corporation will have then no ulterior motives to serve and from the start will be working in harmony with the Federal board.

Imhoff Tanks for Worcester

The most important work now in hand at Worcester, Mass., according to Frederick A. McClure, city engineer, is the preparation of plans for the installation of an Imhoff system of sewage disposal in lieu of the chemical precipitation and filter plant which has been in operation since 1888. This work will consist of 20 Imhoff tanks, six pairs of dosing tanks, and 14 acres of sprinkling filters 9 ft. in depth. The plan is designed for a daily flow of 24,000,000 gal. of sewage, with provision to take care of storm flow of 60,000,000 gallons.

Impressions Here and There

FROM NIAGARA TO OTTAWA

ONTARIO is not very different from the States. Topography and climate, the two great natural factors which affect a people's characteristics, have offset many of the national differences between those who live on opposite sides of the Great Lakes. To an engineer, particularly, the trip from the Niagara peninsula through Toronto to Ottawa does not seem to carry one through strange country until Ottawa is reached. The types of engineer met are the same, the ways of doing work and the habits of thought are identical. In the Dominion capital, though, one begins to feel less at home. Whether it is the burr on the tongue which betrays the birth or training in the British Isles, or the French explanations on the blueprints, there is enough to make one feel that here, at least, the national influences begin to overcome the geographical.

There is, too, one subtle difference. Canada was in the great war nearly five years. Nowhere can this be escaped. Service flags carry much heavier proportions of gold maple leaves than do ours of gold stars. Maimed men are everywhere; service buttons are on the lapels of nearly every man up to middle age and sometimes beyond. And more important still, the heavy burden of war has crushed the spirit more nearly to the limit of elasticity than it did on this side of the border in the 19 months of our participation in the war.

Just how much this depression of spirit contributes to the quite obvious engineering depression it is hard to say, but it is evident that it is partly responsible. Labor troubles in Canada are as prevalent as in this country. The Winnipeg general strike, beaten though it was, left its impress throughout the neighboring province of Ontario, and the threat of labor control has not altogether passed. Everywhere is heard the same complaint, so familiar to American engineers, "Business men will not go ahead with construction so long as prices of material and labor are so unsettled." Prospects for the coming season are not over-bright, due largely to this uncertainty. There has been the same flashy increase in small industrial construction noticed in this country; plants withheld from normal increase during the five years past had to be added to, but the big work—large public construction, power plants, railroad revision and the like—is still holding back for better times.

In Ontario, too, what amounts almost to a political revolution complicates the future. In this country little has been heard of their October elections, but they have some importance for us as an indication of the trend of things. A new party, known as the United Farmers, with a composition well expressed in its name, has come into power and, with the aid of an unexpected number of representatives elected on a straight Labor ticket, will control the provincial parliament to the exclusion of the two established parties, Liberal and Conservative. No one knows whether the farming and labor elements will be able to compromise their many opposed interests to put through the advanced social and economic theories their leaders advocate, but, whether they do or not, the defeat of the old-line parties indicates the usual dissatisfaction with conditions which follows a long war and presages an unsettled state. This, rightly or not, reacts strongly to prevent an industrial or engineering boom.

All these observations are, of course, general. They should not be taken too pessimistically. Engineers everywhere seem to have enough to do, though few of them talk very hopefully of the immediate future, and there are a few outstanding features in construction and planning worth specific comment.

"Hydro."—The first of these is the big Queenston-Chippawa power canal that the Hydro-electric Power Commission of Ontario is building around Niagara Falls. "Hydro," as the Commission is known in Ontario, is a real issue in Canada. One does not have lukewarm feelings about it. Either it is a messianic deliverer from all public-utility ills or it is a socialistic fraud which by clever accounting is leading the people straight to financial destruction. Whatever its purpose or its practice economically, it is doing a big job in a big way at Niagara. Outside of the Miami Conservancy work above Dayton it is the largest construction job today on the continent. Thirteen miles the canal stretches from the mouth of the Welland River to below the Whirlpool, and in those 13 miles are all kinds of digging. More earth-moving machinery of a modern sort is concentrated here than at any place since Panama, and wherever you go along the line, every minute or so there goes trundling by on the well-laid railroad a train of heavy dump cars pulled by a businesslike electric locomotive on its way to the 240 acre farm which is slowly being covered yards deep with the 15,000,000-yds. spoil dump. Other and more technical columns of this journal will tell of the engineering work; let it be sufficient in this comment to confess that a trip along it gave to one engineer, at least, that thrill of pride in his profession that every professional man needs once in so often to counteract the dullness of his routine life.

The Welland Canal.—A few miles beyond Niagara is the Welland Canal. During the war the old canal many times repaid its cost. Through its narrow locks passed many of the lake-built steamers on their way to the fight against time with the submarine. Alongside of these old-fashioned locks are now rising the massive masonry structures of the new ship canal. During the war all work on the new canal was shut down, and the construction machinery was mobilized for war work. In the season just past, over $3,000,000 was spent by the Canadian Government in dredging and concreting and replacing equipment, but work was shut down in September because of labor troubles. At this place Canada tried to put into practice a theory that was popular here a year ago. It opened up the canal work, in spite of many financing obstacles, in order to provide work for the returning soldier and war worker. Unfortunately, the idea did not succeed, for labor became unreasonable in its demands, and struck. The Government did not argue, but closed down forthwith. Today the huge locks, half completed, the dredges, the shovels and the drills look very lonesome to the traveler scooting by on the gasoline "speeder" which rises above all traffic regulations.

Toronto.—Toronto is an American city. Let that be said without condescension. It is Cleveland; it is Buffalo; it is Detroit. Its fine new union station, fast approaching completion, its well paved streets, its frequent skyscrapers, the magnificent new Bloor St. via-

duct, one of the handsomest bridge structures in America, all show the skill and push of efficient engineering. But in one particular it is passing its neighbors across the lakes. That is in its harbor work. Instead of much talk and no action, Toronto is really doing something with its lake front. Seven years ago it began a comprehensive scheme which includes recreational and residential improvement along the exposed shore and industrial development behind the protection of the large island that fronts the city, and throughout the war it has been continuing the work. Most important of all, it is actually beginning to enjoy the fruits of the plan, for industrial plants are beginning to rise on ground which a few years ago was swamp or open water, and the return from the rentals is beginning to repay the costs of the project.

Like the other lake cities, Toronto is planning a traffic center. This one will be on the lake front and will gather all of the long-distance passenger entrance, by train, interurban, ferry and lake steamer. Fortunately, the urban traffic centers in the business district, some blocks inland, so the engineers feel that there is no danger of the congestion which threatens Cleveland if the new terminal scheme there goes through.

Ottawa.—Ottawa inevitably recalls Washington to the engineering visitor seeking information. Not architecturally, because, though favored with far more natural advantages than the American capital, the planning has not been as expert or the building execution so successful, but officially one gets the same reactions. There are the same centralized Government offices, under somewhat different names and with occasionally differing functions, the same vagueness regarding specific activities, the same undue respect for the nearby legislative authority, which can make or break a project. And, curiously enough, there is the same uncanny influence of men and methods imposed by the old-fashioned type of Government building.

Government building architecture a half century or so ago became standardized. It apparently was necessary to make every office a huge, high-ceilinged room, with deep recessed windows, seemingly uncleanable, and fireplaces and mantles of a splendor varying with the distinction of the proposed occupant. No man can be modern in such an office. One enters fully expecting to find letter presses instead of carbons, and file cases of antediluvian origin. Typewriters almost seem irreverent, and one feels sure that in the drafting rooms they grind their own india ink. The surroundings hypnotize the men. As it is in Washington so it is in Ottawa. All too frequently those who occupy the old Government buildings reflect stolid officialdom or affect a freezing coldness which they mistake for dignity. Where, for lack of room, offices have been moved to modern quarters in city buildings, or where the Government has itself put up new structures within a few years, the occupants have the snap and go one expects from a business man.

Perhaps because Ottawa has more architectural relics than Toronto, the feeling of depression was more marked there. Government engineering seemed to be marking time. In railways and canals and the Department of Public Works, whose duties correspond to the civilian field of our Corps of Engineers, little other than necessary maintenance was reported. The international investigation of the power and navigation possibilities of the St. Lawrence, authorized on this side by last year's rivers and harbors bill, is only just starting, the two representatives being now engaged in preparing the program of study. Government railway control is the subject of political controversy just now on account of the current bill before Parliament for the acquisition of the Grand Trunk, and pending a settlement there is not much activity in Government railway circles.

Roads, public buildings and harbors are more active. Under an appropriation of $20,000,000 the Dominion is to assist Provincial road building to the extent of 40%, and the national road commissioner is organizing his department to take care of this work next year. It is not the intention to control construction of Federal-aid roads to the extent practised in this country, but merely to approve design and layout and to see that the provincial road departments are so organized as to guarantee good work, seeking also to coördinate the practice in the different provinces. In harbors, the national Government is underwriting expenditures of $1,250,000 at Montreal and $250,000 at Quebec, and has approved an expenditure of $5,000,000 for initial construction of a huge harbor development at Vancouver. It is also considering taking over the harbor of St. John, N. B., which under ancient royal charter is vested in the city. New public buildings of a monumental sort are about to be started in Toronto, alongside the new union station, and in Montreal. The interesting thing about these two is that they are to be of reinforced concrete. In fact, that material for buildings seems to be having a decided boom through Ontario, notably at Toronto, where several of the large new industrial plants are of concrete.

Ottawa, Nov. 1, 1919

Electrolysis in Underground Structures

LEAKAGE resistance of street-railway roadbeds, and its relation to electrolysis of underground structures, form the subject of "Technologic Paper No. 127," recently issued by the United States Bureau of Standards. Electric railways, says E. R. Shepard, author of the paper, can do much toward reducing leakage currents from their tracks, by observing the following suggestions regarding roadbed construction:

1. Solid-concrete ballast should be abandoned, and clean crushed stone should be used as a foundation under ties. This type of construction is approved by the American Electric Railway Association, as it gives greater resiliency to the track and is cheaper than the full concrete ballast.

2. Where crushed stone or gravel is used it should be kept clean by proper coverings or pavements. If earth, sand, or street dirt is permitted to filter into ballast of this character, its function as an insulating material is greatly impaired.

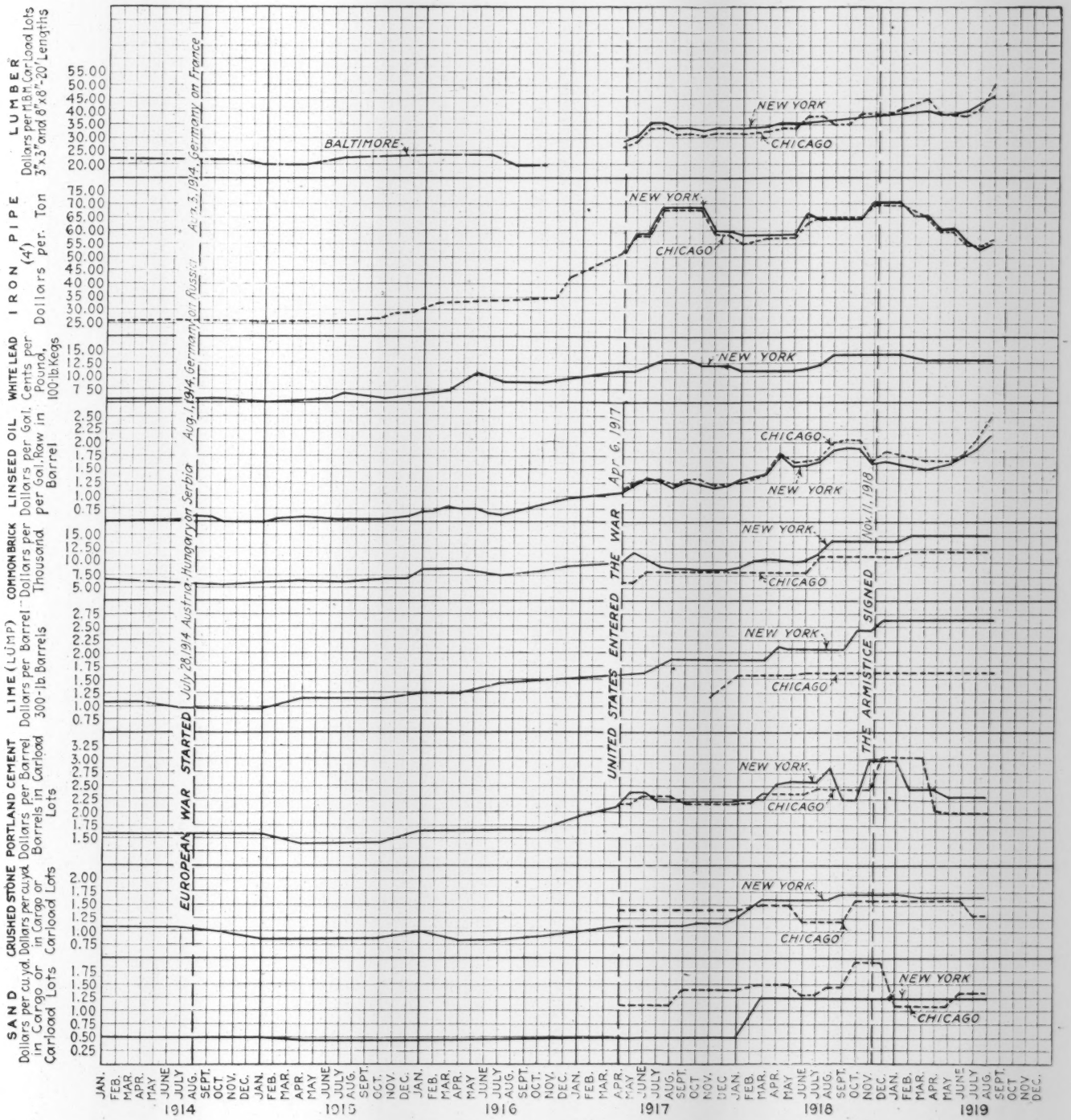
3. Salt, which is often used to prevent frogs and switches from freezing, will greatly reduce the resistance of roadbeds and should be avoided if possible.

4. In open construction, rails should be kept out of contact with the earth. The roadbed should be well drained to prevent fine material from washing into the ballast and to keep the ties as dry as possible. Vegetation should be kept down, as it tends to make the roadbed moist and to fill ballast with foreign material.

5. Zinc chloride and similar chemical preservatives should be avoided where the escape of stray currents is objectionable or where block signals are used. A treating mixture of creosote and gas oil improves the insulating properties of wood ties.

Prices of Building Materials, 1914-1919

The accompanying diagram indicates price changes in building materials during 1914-1919. The data were collected and plotted by the United States Housing Corporation.



COMPARISON OF UNIT PRICES FOR BUILDING MATERIALS, 1914-1919

Data Compiled by M. A. McCarthy, Librarian, United States Housing Corporation

Sources—

Lumber

1914-1916 *New York Lumber Trade Journal.*
1917-1919 *Engineering News-Record.*
*At Baltimore.

Brick

1914-1916 United States Bureau of Labor Statistics Bulletin, Wholesale Prices, No. 149, 181-200.
1917-1919 *Engineering News-Record.*

Portland Cement

1914-1916 United States Bureau of Labor Statistics, Bulletin Wholesale Prices, No. 149, 181-200.
1917-1919 *Engineering News-Record.*

Sources—

Sand

1914 *Record and Guide.*
1915-1916 *Rock Products and Building Materials.*
1917-1919 *Engineering News-Record.*

Crushed Stone

1914 *Record and Guide.*
1915-1916 *Rock Products and Building Materials.*
1917-1919 *Engineering News-Record.*

Lime

1914-1916 Bureau of Labor Statistics Bulletin Wholesale Prices, No. 149, 181-200.
1917-1919 *Engineering News-Record.*

Sources—

Iron Pipe

1914-1916 *Iron Age.*
1917-1919 *Engineering News-Record.*

White Lead

1914-1916 *Oil, Paint and Drug Reporter.*
1917-1919 *Engineering News-Record.*

Linseed Oil

1914-1916 *Oil, Paint and Drug Reporter.*
1917-1919 *Engineering News-Record.*

Columbia Basin Irrigation Project Report Nearly Completed

SURVEYS being made to determine the possibilities and the approximate cost of bringing irrigation water to a large tract of land on the Columbia River in Washington are nearing completion under the direction of the Columbia Basin Survey Commission. This work has been carried on with an appropriation of $100,000, noted in *Engineering News-Record* of Apr. 17, 1919, p. 793. The complete report and cost estimates may not be finished before the first of the year, but in the meantime the following general statement of what the surveys have shown was given to a representative of *Engineering News-Record*:

The tract of land to be irrigated lies on the north and east side of the Columbia River near the center of the state and not far east of the Yakima project. The area is already partly under cultivation, and is served by four main-trunk railways and their branches. Production has been comparatively low, however, because of the slight rainfall and the impracticability of getting irrigation water for small tracts. The project contemplates including all the several small districts that have heretofore tried to get water and supplying also adjoining areas of considerable extent.

A total of 2,500,000 acres in this section has an easy slope to the southwest, and of this about 1,750,000 acres can be irrigated by gravity from a trunk canal along the upper boundary. All this tract of 1,750,000 acres has been classified in sections according to kind of soil, crops for which it is best suited, amount of water required, etc. With these data as to the amount of water required, the report will be able to state definitely that with a very low dam at the outlet of Flathead Lake a water-supply can be secured which will far exceed the requirements of the area.

Flathead Lake, with an area of 120,000 acres, is located in western Montana. From this lake the flow would be through a natural water course some 200 miles long to Pend D'Oreille Lake, in northern Idaho, which has an area of 76,360 acres. The drainage area above the diversion weir at the outlet of this lake would be about 25,000 square miles, from which the run-off is very heavy, and whose high-water season occurs at the time when the maximum irrigation water is required.

Between the Pend D'Oreille diversion weir and the boundary of the tract to be irrigated there would be about 100 miles of canal, tunnel and siphons and 30 miles of lakes or other natural water channels. The open canal would be designed to convey about 20,000 sec.-ft. Twin tunnels will be recommended, but it will be necessary to construct only one at the outset. There would have to be one 15-mile tunnel and several of lengths up to five miles; tunnels and open canal to be lined with concrete. In the case of the siphons the recommendation will be for units possibly about 18 ft. in diameter, to be built one at a time. Six units of this size would be equal to the capacity being recommended for open canal construction. Siphons would be of steel pipe armored with concrete. The only river crossing of importance would be over the Spokane River just above the City of Spokane; this would be on a concrete aqueduct.

Marvin Chase, state hydraulic engineer of Washington, is chairman of the Columbia Basin Survey Commission. Prof. O. L. Waller, head of the department of civil engineering at Washington State College, is secretary; A. J. Turner is chief engineer and J. C. Ralston is consulting engineer. D. C. Henny of Portland has been designated by the United States Reclamation Service to act as consulting engineer to the commission.

Templet Used in Clearing Sand From Irrigation Canals

Winds Blow 60,000 Cubic Yards Into Ditches — Draglines, Plows and Iron Sheaves Used Before Templet Proves Worth

DRIFT sand, almost filling in places the west extension main canal of the Umatilla irrigation project Oregon, and seriously impairing the general water flow, has been removed by a scheme of sluicing and the use of a special templet devised by H. M. Schilling, project manager, United States Reclamation Service. The canal was built during 1914 and 1915 and has been operated since 1916. It is 26¾ miles long, concrete-lined throughout, and has a designed capacity varying from 365 sec. ft. at the head to 77.5 sec.-ft. three miles from its end. It is built through some very sandy areas, and the high winds prevailing in the spring have blown much of the excavated material into the canal.

During the first year the canal was in operation considerable sand was blown into it, nearly filling it in some places between Stations 566 and 1227. Only about 25 sec.-ft. could be run in the canal without overflowing the banks. The high spots between those stations were cut down with teams and scrapers, to allow the passage of 75 sec.-ft., 6127 cu.yd. of sand being thus removed from the main canal. In 1917 similar trouble was experienced, the sand in some places filling nearly to the top of the lining, and during the summer it was necessary to work a channel through by means of a "V," to allow the passage of the small flow required.

During the summer of 1918 the amount of sand blown into the main canal was so large that settlers in the region became alarmed over the possibility of having their irrigation water completely cut off. The first seven miles and the last five miles of the canal were comparatively free from sand deposits, but the intervening 12 miles contained an amount variously estimated at from 50,000 to 75,000 cubic yards.

The first suggestion was that a small dragline, gasoline-driven, with caterpillar tread, operate from the bank with a 30-ft. boom and a ½-yd. bucket, but owing to the difficulty of obtaining such a machine in wartime, and the uncertainty of successful operation of the bucket in the concrete-lined section, the proposition was abandoned. The canal could not be cleaned by teams without turning out the water, which was not desirable, so a means was sought to improve conditions with the least amount of disturbance to the water delivery. The suggestion was therefore made that sluiceways be built at intervals of several miles, and an effort be made to remove the sand by the aid of water.

After two of these sluiceways had been operated, it was discovered that the immediate result was the movement of sand for a distance of ¼ mile, after which distance the sand took a grade of about 4 ft. to 1000 ft. and, with but 30 sec.-ft. of water, all that was available, no further action was effected.

The main problem then became one of loosening the sand and holding it in suspension until it could be re-

moved by the available water-supply. A drag attached to a cable leading to a team on either bank was used with little effect. A farm plow was effective, but was so heavy that it required two 4-horse teams and was given up as too expensive. Two iron sheaves, 16 in. in diameter, attached to a chain, had the desired loosening effect, and could be pulled by two 2-horse teams, but the problem of transportation still remained. The sand was too heavy to remain in suspension, and after being loosened it settled again.

Finally, after study was made of operations above one of the sluiceways where the sand was filled with a growth of moss roots, it was decided to construct a gate or templet to loosen the material. The first experiment was made with a 4 x 6-ft. gate attached to a 4 x 6-in. timber which spanned the canal. The gate was placed inclining upstream, and the water pressure held its lower edge down on the sand. Thus higher velocities were created around the gate, and the sand was dislodged. The sand then settled gradually and eventually washed completely under. The gate was then removed upstream 20 or 25 ft., and the operation was repeated. This method was so successful that it led to the development of the present templet, which consists of a wooden diaphragm about 6 in. smaller than the section of the canal, with an opening 2 ft. wide, running vertically from bottom to top. This permits the increased water velocity to concentrate through the middle directly on the sand, as well as on the sides and bottom. Instead of attempting to work upstream, the progress was reversed, and as the water washed the sand out ahead of the gate the templet was moved downstream a few feet. The water pressure assisted materially in moving the gate, so one man could easily operate it by crossing back and forth on the 4 x 6 and regulating the movement. In this way the problem of transporting the sand with a comparatively small head of water was solved. This last type of templet has been a decided success, and through a systematic program of sluicing, approximately 40,000 cu.yd. of sand had been removed from the canal by May, 1919. Approximately 21,000 cu.yd. yet remain, but the canal may be considered successfully cleaned, with the exception of about 11,000 cu.yd. of sand in the vicinity of Juniper Cañon. It is the intention to remove this before the spring of 1920, by bunching the material with the templet and removing it with teams in order to avoid the long transportation of the sand through sluiceway No. 5.

Under the most successful operation of these templets two shifts were arranged, and several gates were in operation at the same time. Gates were kept about 4000 ft. apart. The larger bars were moved in sections, about 700 to 1000 ft. proving to be the most economical load. In this manner sand was transported above No. 1 sluiceway, a distance of 14,300 ft. Under ordinary conditions a gate progressed about 600 to 1000 ft. per eight-hour shift, depending on the density of the sand deposit. Sometimes several trips were necessary to get the sand out to the desired depth. After the larger portion of the sand had been gone over above No. 1 sluiceway, and the head increased to about 75 sec.-ft., the water was divided at No. 1 and about half passed on to No. 2. This enabled operations to be carried on at two sluiceways at the same time.

Comparative costs of the different methods of sand removal from these canals indicated that the method of using templets was by far the most economical. Records of the team costs show that under favorable conditions the upper portion of the sand bars could be removed for $0.27 per cubic yard. Under less favorable conditions the cost amounted to $0.40 per cubic yard, where teams were very difficult to secure and fresno work could not be done successfully below a depth of 5 ft. on the slope. To have gone deeper it would have been necessary to use slips, and the cost would have been increased greatly. Complete cost records to May 1, 1919, on the sluicing method of sand removal show that the field cost was $0.158 per cubic yard. With the addition of $0.059 per cubic yard for engineering superintendence and all overhead charges, and $0.04 per cubic yard as a plant charge for building sluiceways, the total unit cost becomes $0.257.

In order to avoid recurrence of filling of the canal by sand, considerable work has been done in replacing embankment and covering it with brush for protection against wind. Sand fences of brush were placed at right angles to the center line of the canal, where some of the worst winds operated. Some portions of the banks were sown to rye, but not sufficient moisture fell to start it. Once the canal has been cleared entirely of sand deposit, it is expected that it can be kept cleaned by the protective bank work and by running heads of water to the limit of the canal's capacity.

Safety in Steel Erection—The Equipment and the Men

Teaching and Enforcing Safe Practice—Bulletin for Bridgemen—As to Equipment—Some Safety Principles

By Col. E. A. Gibbs
General Manager, McClintic-Marshall Company, Pittsburgh, Penn.

From a Paper Read Before the Construction Section of the National Safety Council, Oct. 2, 1919.

STEEL erection, like other outside construction work, is done under more difficult conditions than shop work, for the reason that the conditions are varied and continually changing, while in the shop many conditions affecting accidents are fixed. The weather plays a much more important part in the field than in the shop. The force of workmen is much less stable; with the field force constantly changing, it is much more difficult to educate the men to safety and to avoid getting men who are unsafe on the work.

There are, however, certain differences between steel erection and general construction: The loads are generally much heavier and are handled under more varying conditions and at a greater distance from the ground. There is an element of risk in every lift. While the derrick may have been tested throughout and proved safe, an accident may be caused by a bridgeman making one careless hitch on a load of beams.

The appliances for erecting steelwork have been developed and increased greatly during the past twenty years, and erection is relatively much more safe. Nevertheless, many new difficulties have arisen. The average weight of pieces to be handled has greatly increased, while certain limiting features have remained unchanged, such as track clearances and gage. A girder may increase in weight, but the derrick car that handles it must run on and be supported by the same track as previously. This increased weight has had one benefit: Heavy members cannot be juggled and handled

in any manner that the foreman desires; the equipment can be designed to handle these in only a few ways, and the foreman must be governed accordingly. Therefore, the work is likely done as the design of the equipment contemplates and with corresponding safety.

Preventable Accidents and the Workman

Well over half of all accidents are preventable, and the proportion is probably higher. Preventable accidents may be divided into three classes: 1. Accidents due to workmen themselves by reason of being physically incapacitated, ignorant, inexperienced, intemperate, careless or reckless, acting the fool, or to actual disobedience.

2. Accidents due to foremen; improper selection of men placed in charge of work or doing the work; inadequate instruction to workmen; putting men or allowing them to go into dangerous places unnecessarily; lack of vigilance and orderliness on the work; failure to investigate questions of safety made by workmen.

3. Accidents due to superiors; improper selection of foremen, safeguards, equipment for doing the work and instructions regarding its use.

It is believed that the greatest difficulty is with the men themselves. Construction companies long ago recognized the necessity of having proper equipment, and that phase of the situation is in relatively good shape. The foreman, while still skeptical as to the value of certain expedients for safety, can be educated more easily. It isn't so easy to get them to *enforce* safety methods. The conditions on a job are changing rapidly, and the foreman is crowded to make time. He cannot do everything, and naturally devotes his time to things that speed the work and affect the direct cost. Only constant pressure on the question of safety, and using *every* accident to point out the neglect of foremen or men, will bring results.

A Safety Bulletin

The workmen are by nature and training a daring class of men, and instinctively feel that their courage and skill are questioned when they are asked to comply with many of the expedients for safety. However, they can and must be educated to take proper precautions to protect themselves and their fellow workmen. Bulletins, notices and placards of various kinds containing written and illustrated cautions and showing effects of neglect are very good. Our company, in 1910, issued a book to its foremen containing instructions and cautions for the prevention of accidents. We also started at that time to post a bulletin pointing out certain of the most common faults of workmen and how to avoid them. A small copy of this bulletin is handed to each bridgeman whom we employ. It contains several short paragraphs, as follows:

Don't Be Reckless—More accidents occur through recklessness than any other cause. Don't walk on rods. Don't ride a load. Don't ride on a locomotive crane.

Don't Be Careless—Look where you step, and be sure that on what you step is safe and secure. Don't step on ends of loose plank. Don't start to slide down a line unless you are sure the ends are fastened.

Be Orderly—Do whatever you do in an orderly, careful manner. Pile material so that it cannot roll, fall, tumble or be blown over. Don't let tools or equipment such as bolts, nuts, drift-pins, blocks, dolly bars, etc., lie around so that they can be knocked off the work or so that anyone can fall over them.

Unfit Condition—Don't go to work if you have been drinking or do not feel well. If you are lame or have any defect in hearing or eyesight you should not work at this business, as by so doing you endanger your own and fellow workmen's lives. If you are inexperienced in, or unsuited for the work to be done, don't undertake it.

Be Vigilant! Watch What You Are Doing—Don't stand or work under a load. Don't go in the "bight" of a line nor stand in front of a snatch-block. Don't work on or about a crane runway when the crane is in use unless there is a stop between you and the crane.

Don't Use Unfit Tools—Be sure the tools and equipment you use are in good working order. If they are not, don't use them.

DON'T WORK WITH MEN WHO DON'T OBSERVE THESE RULES.

Cautions as to Equipment

The first requirement for safety in erection is to have the proper equipment. And it is not enough to provide first-class equipment. It must be kept in good condition by constant attention on the job and by overhauling at the completion of the job if necessary. Some of the principles observed by our company regarding equipment are: (1) Use no wooden travelers or derricks, except very light derricks and jinnywinks; (2) all castings in erection equipment carrying any strain to be made of steel. We make all of our sheaves for cable blocks, except small blocks for ⅝-in. cable, of steel. All castings when bending strains are encountered are made of vanadium steel. Vanadium insures a more uniform casting and tends to eliminate blow-holes; (3) forgings of importance, such as the headblock of a derrick car, are made of nickel steel; (4) use the very best manila lines; (5) use cable slings, instead of chains; *very important;* (6) automatic brake in addition to mechanical brake on all electric hoists.

Erection equipment should be so designed as to make all stresses as determinate as possible. Even then the many positions in which a load can and will be handled will produce more varied strains and conditions than occur in bridges or other permanently fixed structures. Be sure that all stresses and combinations of stresses are fully cared for. Then, not only make the main members strong enough, but pay especial attention to details. Most failures in erection equipment are primarily due to poor details. Booms with light lacing or lacing improperly detailed are common. Poor detailing often produces very great bending stresses that are ignored.

Erection equipment should be most carefully inspected during its manufacture, and test reports required for steel castings, all alloy metals and steel cables. The assembling and erection of a traveler or heavy derrick should be carefully done, to insure that no stresses are introduced by improper alignment. This is extremely important. Booms and traveler hoists should be tested with gradually increasing loads before using them to full capacity. While in use they should be inspected frequently to see that no weaknesses have developed through wear or other means, and that the equipment is working as designed.

Instructions should be issued as to just how equipment on heavy work is to be used, and nothing left to chance. A movement of a very short distance in the setting of a traveler or in radius of a heavy boom may be perfectly safe as far as the equipment itself is concerned, but may endanger the falsework or the permanent structure.

In the erection of falsework, great care and an accurate knowledge of conditions are necessary. Timber should be carefully inspected, and none but of good quality used. In case mudsills are used, examine the soil carefully and provide sufficient mudsills to support the load with ample safety. The matter of bracing the falsework bents themselves, their connection by bracing and struts, and the fastening of the end bents to the piers or abutments so as to prevent any longitudinal movement of falsework, are all points where too much care cannot be exercised.

Seventeen Cautionary Principles

Following are some cautions that if followed will prevent many of the accidents in steel erection:

1. Select the proper man for the particular task in hand.

2. Do not order men to work in unnecessarily dangerous places, and be on the alert to see that they do not run unnecessary risks of their own volition.

3. Do not allow the men to work on corrugated iron roofs or steel when there is a coating of ice thereon.

4. Walking on rods, riding loads or locomotive cranes, sliding down lines without inspecting the fastening, standing in the bight of a line or in front of a gate block, are all unnecessary risks and should not be permitted.

5. Do not permit men to work about crane runways without placing an effective stop between the men and the traveling crane, and see that the electric wires are properly insulated.

6. Require the rivet boss to inspect carefully all riveting scaffolds. Improperly hung scaffolds have caused many serious accidents. Only the best material should be employed. Clear spruce is the best.

7. Pipe used as needle beams should not be spliced.

8. All scaffold plank should have a stop bolt about 6 in. from each end to prevent it from slipping off the needle beam, and if the scaffold is inclined it should have cleats nailed on the plank. All scaffold material should be tested for twice the load it is expected to carry. Even this care will not suffice unless the men are careful. This was demonstrated in a case where a riveting gang used their scaffold as a brace for an air buckup. The scaffold—amply strong for its purpose—broke under this sudden additional load, and the men fell into the river.

9. On high bridge work, scaffolds should be provided with a railing. This is a requirement by law in some states.

10. Piling of material must be carefully watched, particularly with heavy work. Skids should be amply heavy and level, and the piles not topheavy. Poor piling of material is responsible for a large number of accidents.

11. When it is necessary for men to work above other men, put up a danger sign calling attention to the fact that men are working overhead.

12. Keeping small tools in condition will avoid many accidents.

13. Wearing of goggles while chipping is a necessary precaution, but one the men dislike to follow.

14. In the use of cable slings, inspect them frequently and keep them properly oiled, and in handling heavy loads pad the sharp corners to prevent cutting the cable.

15. If a boom or other derrick section is bent or damaged and then straightened in the field, do not use if for the maximum load until it has been replaced with new material.

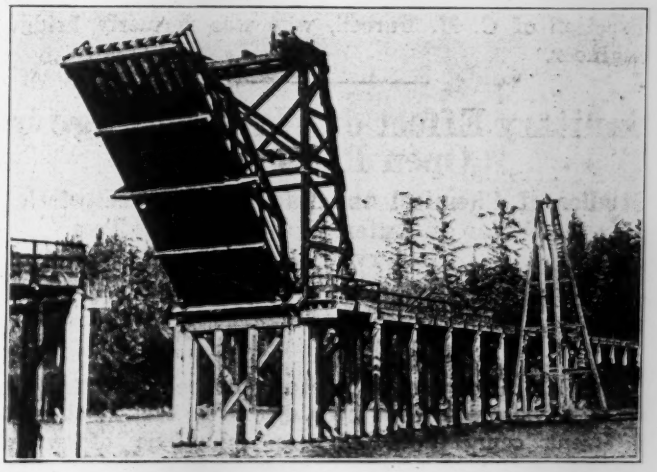
16. Do not put too much lashing in the hook of a gate block. It will cause the hook to open up and fail.

17. Keep bystanders away from the work.

Spiral Drums for Operation of Timber Lift Spans

Opening of Small Oregon Bridges Made Easier for One-Man Operation by Winches—Typical Details for 40-Foot Span

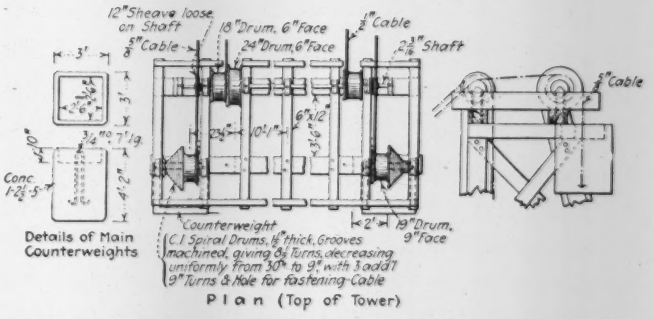
OPERATING details of a 40-ft. timber lift span are here described. Six or seven such spans, of which the one illustrated is typical, have been constructed by the bridge department of Oregon over openings at navigable sloughs along the coast of that state where traffic requires only infrequent operation. The adoption of spiral drums supporting the concrete counterweights resulted from the desire to make op-



TYPICAL TIMBER LIFT SPAN WITH SPIRAL DRUM

eration as easy as possible. These short spans have been approved by the United States War Department, and are designed as a cheap contrivance which can be operated by one man, as most of the boats which pass through these openings are of the one-man type.

The operating mechanism in these spans is simple, consisting of a hand winch located on the approach near the hinges. The ½-in. cable from the winch is passed over a drum vertically above it and fastened to the end of the needle beams of the timber span. The



PLAN, TOP OF TOWER AND DETAILS OF COUNTERWEIGHTS

greater portion of the work of opening this span is done by the concrete counterweights. These counterweights are hung from the spiral drums located at the top of the tower. When the bridge is closed, the counterweight cable is located on the large diameter end of the spiral drum to give the maximum lever arm and counterweight effect in that position. As the bridge is raised, the lever arm of the counterweight constantly diminishes, and thus preserves a uniform pull on the truss in its various positions.

To open the span, the operator starts to wind the winch, and as the truss rises from its position an automatic gate located at the open end begins to close by the release of a trip. The gate comes to a final closed position when the draw has been raised about 8 or 10 ft., and remains closed until the span is lowered. The maximum clearance which can be obtained with this type is an angle of about 60 degrees.

When it is desired to close the span, it is lowered by means of a hand brake similar to the emergency brake of an automobile. It is under easy control of the operator at all times.

The foregoing details were furnished by C. B. McCullough, bridge engineer, Oregon State Highway Commission. The details illustrated were drawn under the direction of C. H. Purcell, who was formerly bridge engineer.

Sanitary Effect of Water Storage in Open Reservoirs

Studies of Chemical and Bacterial Characteristics of Water on Entering and Leaving Two Reservoirs in Maryland

By Abel Wolman and S. T. Powell

Maryland State Department of Health, Baltimore

Baltimore County Water and Electric Company

THE sanitary importance of storage reservoirs for water-supplies has been discussed in a number of different connections. Where valuations of water systems are under consideration, storage reservoirs often assume a value, on account of their purification power, greater than would be normally accepted upon the basis of their quantitative capacity only. In such cases, the true sanitary effect of storage is a moot question, since the confusion between the nominal and actual sanitary capacities of reservoirs still persists. The general tendency, therefore, in such discussions is to measure the sanitary performance of the reservoir in terms of capacity units. Such measurement leads one into error, since two reservoirs of the same physical capacity may not necessarily produce the same sanitary result. This confusion of nominal and actual capacities appears also in practically all attempts to improve water-supplies by filtration subsequent to storage. The arguments pro and con in these situations are rarely on common ground, because of this same interchanging of sanitary and capacity units.

Another source of error in estimating the effect of storage upon the sanitary quality of water arises from the *a priori* reasoning from one reservoir to another. In this manner, attempts are sometimes made to assign relative sanitary values to storage accomplishment based upon experience in other localities. This gives rise to the quantitative conversion of effects observed in storage reservoirs which have actual capacities measured in months, to those supposedly obtainable in reservoirs of capacities measurable only in days or weeks.

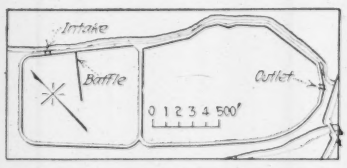
Having such problems as the above in mind, the present writers have made a series of studies upon the general question of storage functioning. Our plan is to secure quantitative material regarding the physical, chemical and bacterial characteristics of waters entering and leaving different storage reservoirs and obtain in this manner certain measures of the minimum performances of different types of reservoirs. This present discussion is the first of such studies intended to add to our present fund of material regarding storage effects. It has been prepared in the course of investigations in the Engineering Department of the Maryland State Department of Health, under the general direction of Robert B. Morse, chief engineer.

1. *Description of Reservoirs*—The reservoir system used in this initial study of storage effects is one operated by the Baltimore County Water & Electric Co. on Herring Run. The system consists of two reservoirs, in series, at Highlandtown. These reservoirs are in continuous operation, and have a combined nominal storage capacity of 21 days. The lower reservoir, put in use about 24 years ago, is an excavated earth basin, around which a bank was placed. When it was first put into service the top soil was not stripped, but later the greater portion of it was removed to a depth of 12 in. About seven years ago a concrete facing was built on the bank of the lower side of this reservoir, so as to prevent high turbidities in the water on account of washing of the slopes during storms.

The second reservoir was built only four years ago, and is also of earth. The top soil from this basin was practically all removed before it was put into service. This reservoir acts as a preliminary settling basin, the water passing directly from the effluent chamber of this reservoir to the lower one. On the lower reservoir there are three outlet gates at different elevations, so that water is always drawn therefrom at the surface.

The raw water feeding these reservoirs is supplied by Herring Run, a small surface stream subject to the surface pollution of the drainage area. The water is usually high in organic matter in suspension and in solution. Algæ growths in the stream are usually not high, but develop after the waters enter the reservoirs.

2. *Analytical Data*—The data reported in this brief study have been collected during a period of three years. In each characteristic reported, the average number of samples was approximately 100 at each station. The samples represent at all times the water (1) entering and (2) leaving the reservoirs, and do not include the stream waters which are sometimes bypassed during periods of excessive turbidity. The effluent sampling station was located at the outlet of the second reservoir, so that the changes in chemical, physical and bacterial characteristics are due only to the complex storage effects in the two reservoirs.

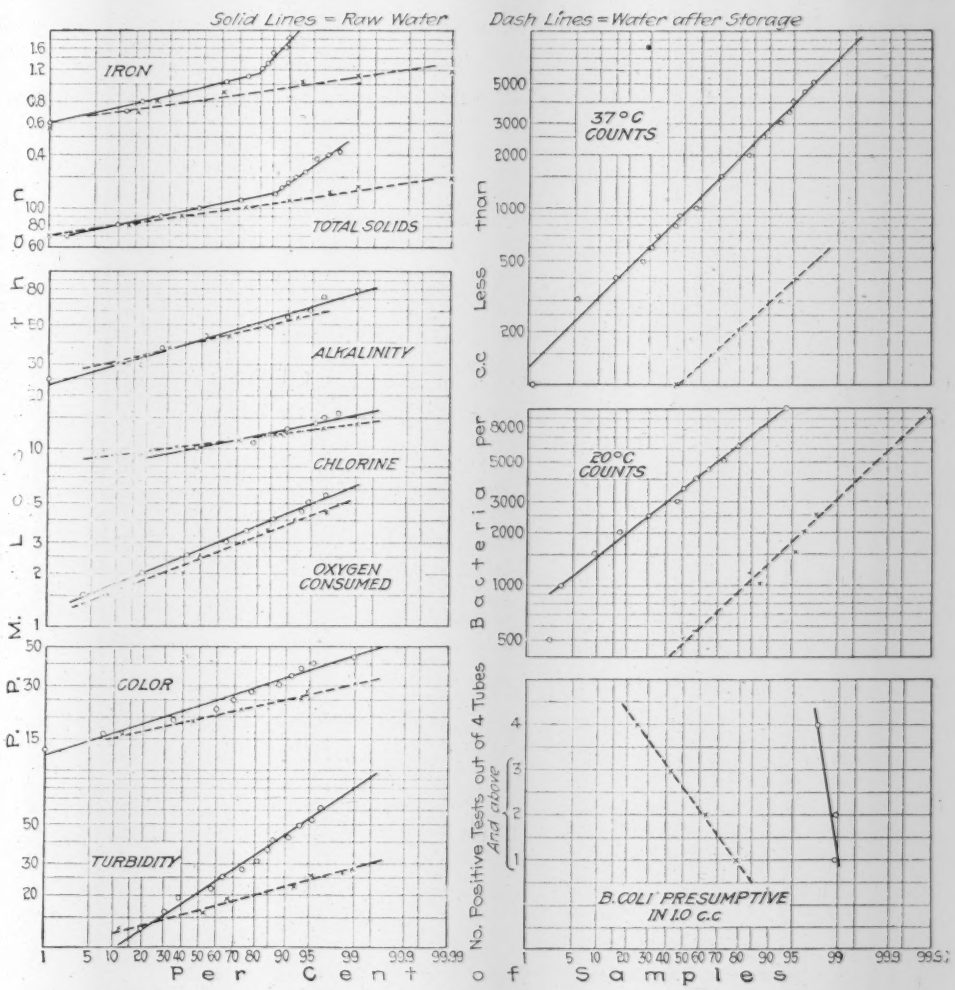


SAMPLING POINTS AT RESERVOIR INLETS AND OUTLETS

The analytical determinations were all made according to the 1917 A.H.P.A. Standard Methods of Water Analysis. The data were then classified for each station and plotted out on the accompanying charts.

3. *Charts*—The graphic presentation of the results on the charts requires little explanation. Probability paper designed by Allen Hazen is used. Its advantages lies in the fact that the material may be presented in its entirety, so that a complete picture of the distribution of the results is obtainable for each characteristic at each station. On all the charts the samples at the inlet to the first reservoir are represented by continuous lines, while those at the outlet of the second reservoir are shown by discontinuous lines.

It is not thought desirable to make any conclusive statements regarding the data here presented, since it is thought that the reader will be in a position to interpret the facts for himself by mental comparisons with the performance of other purification processes. It is believed that the charts are sufficiently complete to give a clear quantitative picture of the effect of storage upon the important chemical, physical and biological characteristics of a water. Emphasis should be placed, of course, upon the fact that these findings are typical only under the special local conditions of storage already described. It is our purpose to present in later studies further quantitative evidence of the changes in storage in other types of reservoirs.



BACTERIAL AND CHEMICAL RANGES FROM INLET TO UPPER AND OUTLET TO LOWER RESERVOIR

4. *Preliminary Conclusions*—It is not amiss, however, to indicate briefly some outstanding features displayed by the data on the charts. In the case of turbidity and color, for example, the action of the particular storage under discussion appears to be almost entirely one of levelling. In other words, the total cumulative decrease in these two physical characteristics is by no means appreciably high, but the holding in storage, as we should expect, results only in a diluting effect, in a reduction of maximum values, and in a general ironing out, without any complete removal. This levelling without complete removal represents, in this instance, the shortcoming of storage as opposed to filtration, since the latter may be expected to produce at least a water completely free from turbidity.

In the case of the alkalinity, chlorine, and oxygen consumed values, storage plays little or no part, other than giving slight diluting and sedimentation results. In its effect upon these qualities, however, filtration also has no considerable importance.

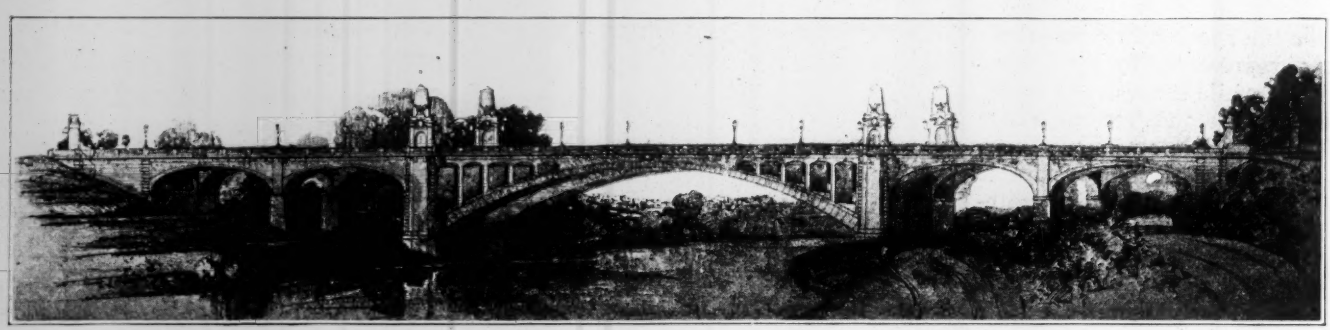
The data for iron and total solids are of interest in illustrating the marked tendency of storage to eliminate excessive chemical constituents of a water, by means of dilution and sedimentation. But in these instances, as with turbidity and color, filtration usually offers greater promise of complete removal than of simple equalization.

The nature of the bacterial changes resulting from storage is similar to that consequent upon filtration processes (which term we have assumed to include coagulation and short-period sedimentation). In the degree of these removals, however, filtration takes a considerably higher rank. The bacterial reductions induced by the storage factors of equalization, sedimentation and devitalization appear to have a limiting maximum value, in the storage reservoirs here described, which is considerably lower than that possible of attainment in an efficiently operated filtration plant. This conclusion, although obvious to some water-works officials, is still subject to controversy in a number of municipalities, where improvements in sanitary quality are often blocked through the unfortunate existence of a cure-all storage reservoir. The cause of this failure of storage to produce bacterial results comparable with those of filtration lies probably in the fact that, in the first case, complete bacterial destruction is predicated upon the absence of a continuous minority of bacterial growth, which largely is to be expected, while in the case of filtration in the last-mentioned desideratum is of far less importance, since the natural processes, upon which storage depends to a large degree, are here reinforced by effective artificial means of destruction. Whereas in storage bacterial removal is largely a function of time, in filtration it is dependent upon effective artificial and natural barriers, and since the latter are more easily controlled and modified, they may be expected to produce better results.

Choose Wilmington Bridge Engineer by Competition

Five Engineers Asked to Submit Designs for New $500,000 Memorial Structure—Each One Is Paid $500

FIVE engineers were each paid $500 by the Washington Street Bridge Commission, at Wilmington, Del., for the designs, plans and estimates for a proposed memorial bridge in that city. As a result, one of the engineers, B. H. Davis of New York City, is selected to prepare the final plans of the bridge. It is expected that bids for the construction will be opened before the end of the year.



ARCHITECT'S PERSPECTIVE OF THE NEW WASHINGTON STREET MEMORIAL CONCRETE BRIDGE AT WILMINGTON, DELAWARE. CENTRAL SPAN 250 FEET

The Washington Street Bridge Commission was created by an act of the General Assembly of the State of Delaware during its last session, and received authority and power to construct a bridge across Brandywine Creek at Washington St., in the City of Wilmington. The commission consists of Alfred I. du Pont, chairman; B. F. Shaw, J. S. Rossell, I. C. Elliott and Albert Stetser. After the formal organization of the commission Frederick W. Carpenter, formerly division engineer in charge of construction of the seventh division of the dual subway system, Public Service Commission, New York City, was selected as executive officer and consulting engineer.

Competitive general plans and estimates were invited May 26, 1919. The invitation indicated the general character to be given to the proposed structure, the width of the roadway and sidewalk, as well as the loading and stresses in specific terms. Competitors were required to submit with their estimates a schedule of quantities and unit prices and total costs of the various classes of materials entering into the construction of the bridge, the limit of total expenditure in connection with the erection of the bridge being $500,000. Competitors were required also to submit, with their plans and estimates, photographs of structures that they had designed, with their location, also a list of references and a proposal for engineering work involved in the preparation of detailed plans, specifications and supervision of construction of the bridge. The time set for the submission of these plans and estimates was July 1, and a fee, as stated above, of $500 was named as full payment for suitable studies and estimates in accordance with the invitation.

The invitation was sent to six designing engineers and architects in various parts of the country. Five responded and submitted, collectively, 10 different designs. To each designer was given a hearing by the commission, subsequent to the submission of his design. After careful consideration of the designs and estimates, the commission July 29 invited all the designers who had accepted the original invitation to submit on or before Aug. 13 new plans and estimates for a stone bridge or a combined stone and concrete bridge. Those who had already submitted plans providing for stone treatment were permitted to submit any alterations in their plans and estimates which they might desire to make.

On this basis some additional designs and modifications of designs were submitted. On Aug. 14 the commission, after further consideration and comparison of the various designs and estimates, accepted the general design submitted by Benjamin H. Davis, engineer, New York City, in collaboration with Capt. Vance W. Torbert, architect. Mr. Davis and Captain Torbert are now elaborating and completing general plans and a form of contract and specifications, under the direction of the commission, for a bridge in general according to the design shown in the accompanying architect's perspective. Diamond-drill core borings are now being made at the site of the proposed bridge.

The total length of the bridge, including the approaches, will be about 700 ft. It will consist of two arches of 70-ft. span at the southerly end, a central span across the Brandywine of 250 ft., and two spans at the northerly end of approximately 85 ft. each. The end or flanking spans will have closed spandrels, the main or central span open spandrels. The total width of the bridge is tentatively fixed at 82 ft., made of two sidewalks of 16 ft. each, including balustrade and nosing, and a roadway of 50 ft. All arches will be composed of three reinforced-concrete ribs carrying, through the medium of spandrel walls and columns, some type of reinforced-concrete bridge floor or deck. It is expected that the balustrades and pylons will be of stone, and consideration is being given to the use of stone for the facing of spandrels and arch rings and possibly for the other portions of the structure.

The loading and stresses provided for in the preliminary request for designs were as follows:

The bridge should be designed to carry a train of 60-ton electric-railway cars on each track, each car to be assumed to have an overall length of 60 ft.; a distance c. to c. of trucks of 37½ ft., and a truck wheel base of 6½ ft.; and also on the roadway at each side of the tracks a line of 20-ton trucks having 12-ft. wheel bases and 6-ft. wheel gage, 14 tons to be on the rear wheels and six tons on the front wheels, trucks to be spaced 30 ft. c. to c. along the roadway; load on sidewalks assumed to be 100 lb. per square foot. To all of these loads 50% should be added to provide for the effect of impact and vibration. The structure

should be so designed that the stresses produced by these loads and by the dead load of the structure itself shall not exceed 100 lb. per square inch in shear or 500 lb. per square inch in compression in concrete, or 16,000 lb. per square inch in tension in steel.

Elements of Value in Pittsburgh Street-Railway Case

New Analysis of Cost of Financing in Engineers' Board Report—Itemized Allowances for Omissions in Inventory

A NEW form of analysis of the cost of financing is presented in the recent report of the Board of Engineers, consisting of F. Herbert Snow, Robert M. Feustel, George W. Fuller, J. A. Emery and Morris Knowles, to the Public Service Commission of Pennsylvania on the valuation of the Pittsburgh Railway Co. This item is included in "structural overhead cost," which is defined as the fixed expenditure which has been made and would have to be made again in reproducing the propery, but cannot be accurately apportioned among the various items of the inventory. The report is rendered on seven bases of cost, according to various periods, ranging from the time of construction to 1922. Allowances for omissions and contingencies are itemized in detail for various portions of the inventory.

The first basis of cost (historic) deals with the total cost of creating and developing the properties and underlying companies, as determined by statements prepared from books and records, supplemented by estimates where necessary, and the remaining bases deal with the estimated costs of reproduction new of the existing physical property, as determined by the application, to the inventoried property as of Apr. 1, 1918, of prices fixed for each of the several bases as follows:

"Original Prices" makes use of prices current during the year in which each portion of the construction was done or equipment installed; "Average 1906-1915" makes use of arithmetical averages of the prices paid from 1906-1915, inclusive; "1918 at 20-Year Trend" makes use of prices indicated for 1918 by the trend of prices for 20 years previous to 1916; "Average 1914-1918" makes use of arithmetical averages of prices from 1914 to 1918, inclusive; "Average 1918-1922" makes use of arithmetical averages of actual prices for 1918 and 1919, and of estimated prices for 1920, 1921 and 1922; and "Current" makes use of prices current at the date of inventory, Apr. 1, 1918.

Allowances for Omissions and Contingencies

The report defines structural overhead costs as including (1) engineering and superintendence; (2) legal services, administration and miscellaneous general expenses; (3) interest during construction; (4) expenses during construction and (5) financing, but not including allowances for omissions, incidentals and contingencies, as follows:

No allowance: Special work; trolley wire supports; poles and fixtures; electric equipment of cars.

½ of 1% allowance: Rails—cuts, loss and wastage for suburban work; all cars except service equipment—to cover attachments only (a: see footnote a).

1% allowance: Rails—cuts, loss and wastage for city work; tie-rods and rail braces—loss and wastage; service equipment (a).

1½% allowance: Ties—excess ties at joints.

2% allowance: Field rivets (where manufacturer's shipping weights of steel were used); paving.

3% allowance: Joints and bonds—open track; substation equipment—incomplete inventory; shop equipment—incomplete inventory.

4% allowance: Feeders and transmission system—incomplete inventory, construction loss and wastage.

5% allowance: Joints—city track; signal—incomplete inventory (a); telephone and telegraph lines—incomplete inventory; underground conduits—loss and wastage; furniture; miscellaneous equipment—incomplete inventory; electric equipment of cars—incomplete inventory of spare parts only (a); track spikes; bonds—city track.

6% allowance: Ballast, open track—compacting, loss and wastage.

10% allowance: Grading outer city—for shrinkage and incomplete inventory; pipe culverts—incomplete inventory; roadway machinery and tools; farm crossings.

15% allowance: Fences and signs—incomplete inventory (a).

The cost of engineering and superintendence was determined as 4% by weighted averages of various items of the property. Administrative, legal, miscellaneous and general expenses of construction were estimated as 3.5% and include the compensation of administrative officers during construction, the development of satisfactory public relations, supervision of legal and engineering departments, and office expenses. Interest during construction was reported at 6% to 11% of the total property expenditure, according to short-time loan rates prevailing during the years covered by the bases of the valuation, assuming that one-quarter of the property would go into operation 18 months after the beginning of construction and that one-quarter would go into operation at the end of each of the following three years. Taxes during construction were determined as 0.7% on the cost of reproduction, on the basis of the company's records.

Cost of Financing Distinct From Bond Discount

The cost of financing is determined as 3% on the basis of original prices and as 5% on the basis of current prices Apr. 1, 1918. The board unanimously reports its opinion that there is an element in the cost of financing distinct from bond discount, and that this element may properly be considered an overhead cost in the same class with engineering and legal expenses, and consists of compensation for bankers' services and cost of underwriting security issues. It is stated that the expense involved in assembling the necessary capital for a large property may not be present in the case of a smaller one. This expense is commonly met by money obtained from the sale of securities, so that the company receives less than sale price. The element of cost for bankers' services in marketing securities consists of personal and corporate service and expenses of examination, negotiation, advertising and selling through all of the various stages until the sale to the final investor. This expense would be incurred whether the securities were marketed by bankers or by the company's own salesmen. In the issue of securities running into many millions of dollars it is necessary to arrange for the underwriting of the issue by a large firm or syndicate, so that it may be promptly marketed without even a temporary lack of funds to embarrass the company or halt construction, this item of expense being given as the second element in the cost of financing.

In reference to bond discount the report states:

Frequently, in selling the securities, the foregoing costs are merged with an additional definitely recognized element

(a) Percentage to be added to costs and not to qualities. In small buildings and timber bridges the allowances for construction wastage were provided for in the unit prices.

Frequently, in selling the securities, the foregoing costs are merged with an additional definitely recognized element which reduces the sales price of securities below par value. This element is that of bond discount which may be required to attract investors and which is a mere adjustment of the stated rate of return on the securities to yields prevailing at the time of sale. In essence this discount is absolutely distinct from the true costs of financing; it is virtually a prepayment of interest which is disregarded by this board in conformity with decisions of the commission in estimating structural overhead costs. It is properly to be taken care of in rate of return.

The cost of "organization and development prior to construction" is defined as compensation for services and expenses necessary in the organization and development of a company from the time of its inception to the time when the charter, franchise and other rights have been obtained, and agreement obtained to furnish the capital and the project brought to a point where construction can be commenced. The item includes: (1) Compensation for promoters on a reasonable salary basis; (2) clerical costs; (3) general expenses; (4) advertising; (5) expenses for obtaining charter; (6) expenses of obtaining franchises; (7) legal expenses; (8) technical expenses; (9) expenses of consolidating smaller companies, and (10) interest during this period.

The board defines "working capital" as the mobile capital required in addition to the fixed capital, consisting of two elements, the first of which covers general stores and supplies, and the second, cash funds necessary to meet irregular payments and enable the company to buy in an advantageous market. The amount of necessary stores was determined by inventory of stocks in storehouses and storage yards, as carried on the general account of the company. The balance sheets of the company were used in determining average amounts of working capital carried on hand. A second method of estimating this element is given as assuming that it is, exclusive of materials and supplies, equal to one month's operating expenses.

A Common Professional Platform

Opening Address of Thomas R. Kimball, President, the American Institute of Architects, at the Inter-Professional Conference, Detroit, Nov. 28, 1919

Opening the Inter-Professional Conference in Detroit, Nov. 28, 1919 (the details of which are reported in this issue, p. 835 T. R. Kimball, of Omaha, president of the American Institute of Architects, laid the groundwork for the discussions of the conference. He justified the foundation of a new association on the ground that there was need to organize against the commercialism of the day, and to bring the professions forward in unswerving support of the professional principle. He pointed out the difficulties to be met on account of misunderstandings and jealousies between the professions, but hoped that all could come together on a common platform of unselfishness as opposed to commercialism, erecting on that platform a standard "calling for skilled service wherein the common interest of all mankind is first considered, the client second, and self last." Mr. Kimball's address, in full, follows:

A DEFINITE, far-reaching, purposeful object is, I take it, the only possible excuse for suggesting further organizing a machinery-laden, overorganized, unhappy, perplexed, well-nigh discouraged humanity.

Essentials to such an object should be:

1. Undebatable justification of the object itself.

2. A common viewpoint from which to consider its problems.

3. A clear understanding as to who are rightly concerned with it, and an intelligent prognosis, which shall point out the obstacles that *will* be met, and that *must* be overcome, and

4. A simple program that promises a result.

I should concentrate the purposes of this gathering on the formation of the strongest, most effective, far-reaching organization that can be conceived.

As justifications of such an object, I offer:

1. The present dire necessity of mankind for some so far unevident defense against our present chaotic expectancy.

2. The all-too-apparent dominance of commercialism in most existing organizations.

3. The fact that the professional principle seems to offer the one so far unorganized social element, and at the same time, as I understand it, the one and only one that can hope to qualify as noncommercial.

4. The present subservience of the professions.

5. Their meager contribution, except as the servile doers of the will of others—witness, the spectacle presented by the recent august conference called by the President of the United States, in his untiring effort to harmonize labor and capital, wherein the representatives of a great profession, unaccredited as such, however, retained by the contending interests, unmindful of that higher professional obligation, completely nullified each other's endeavors, endeavors which if combined for furthering the objects of the conference might have offered a solution of its problem, instead of a potent contribution to its failure.

Continuing in justification of organizing, I offer also the total failure of the so-called professions to overcome the baneful effect of jealousies inherent in the interrelation of all arts and sciences, and the failure to get their disciples past the breadwinning stage in time to contribute worthily to either art or science.

Should none of these reasons seem sufficient, I would justify this conference by the belief that most, if not all, of our professional ills can be cured by the *right sort* of an organization.

Our hope of accomplishment lies, I think, in a clear common understanding—a single thought language in which to discuss and clarify—for unless we can, in common, differentiate between unselfishness and greed—and distinguish professionalism from its counterfeits—our task is hopeless!

In considering who are rightly concerned in this matter, we should, I think, look first to those who see in professional life something more than the obligations of business and art, for every so-called profession will, I am sure, be found to have, and to cling to, its accepted prerogatives; and in each group that professes there will be found a very small percentage who practice what they profess.

Each art and science will be found almost hopelessly jealous of all kindred callings, and within each group individual jealousies will prove the order, not the exception. The finding of a common understanding of what a profession is will in itself be no easy task, while agreement on essential professional qualifications will, I prophesy, go far to justify all the accusation embodied in what I have just said.

Let a clear and none-too-optimistic forecast lead us to approach our problem with appreciation of its difficulties. Let us make a great effort to be unselfish. Let each try to see with the other's eyes—and let us join in the hope that a common understanding and a clear way may be shown us.

In the matter of program for this meeting, I hesitate to lessen the range of possibilities by making even a single suggestion, yet I feel so strongly on certain points that I must offer some ideas at the risk of thereby proving my own disqualifying selfishness.

It seems to me that we should keep before us the creation of an instrument, big enough and broad enough, to make known to the public the fundamental principle of professionalism and to secure for it recognition and acceptance. And to that end, we should strive for qualifying standards far more human and far less technical than any so far advanced.

I should wipe out that time-honored distinction which for so many years has sought to limit the professions to the "cloth," law, medicine, Army, and Navy.

I would warn against trying to form any coalition of the recognized vocations through their representative organizations. I would seek to establish, instead, a single, fundamental qualification, based on unselfishness as opposed to commercialism. And on that as a foundation I would erect a standard, calling for a skilled service wherein the common interest of all mankind is first considered, the client second, and self last. Under such a flag let us rally all who can and will practice according to that creed!

Let us try this in the belief that the object is worthy, the opportunity here—and to justify our abiding faith in mankind!

If in this work we can avoid all stereotyped philosophies and theories and look only to a practical way to gather and harness skilled brains and big hearts, wherever we find them joined, I venture the opinion that a defense will be found before which commercial greed will stand checked, and behind which life—human life—will at last find sanctuary.

"Service Charge" for Water Defined

E. O. Edgerton, president of the California Railroad Commission, during the recent hearing of the Spring Valley Water Co.'s application for an increase in rates, gave a definition of the "service charge." He declared that the charge was the only method of making every person bear a share of the cost of maintaining an ability to get water service on demand. He gave the definition following a description of the service charge by Allen Hazen, consulting engineer, of New York. President Edgerton said:

"Mr. Hazen, is this a fair statement of the philosophy of the service charge? In addition to the direct charges which you have mentioned, such as collections, interest on meter installation, etc., there is a cost for holding the service ready for use, of which, in fairness, everybody attached to the system having available the service of the system should bear a portion; the only way it is possible to make every such person bear a portion of the cost is to assess a charge, whether the water is used or not, a charge which represents the ability of the consumer to get water whether he used it or not."

"I accept that as a very, very complete statement of the case," replied Mr. Hazen.

The Personal Element—

A Discussion of One Phase of Industrial Unrest and a Suggested Remedy.

By P. B. McDonald,
Assistant Professor of English, New York University

A WELL known engineer who has had experience in executive work has remarked that it is not difficult to find clever men, but that it is exceedingly difficult to find clever men who will work together. This very human trait, reminiscent of the reason why we see no Irish bands, since each member would want to be leader, was much in evidence during war activities, and is becoming more and more of a problem in industry.

At Nitro, W. Va., for instance, where many millions of Government money were spent on a great smokeless-powder plant, the directing representative of the War Department, Milo S. Ketchum, was kept busy settling disputes over conflicting authority. Like General Goethals at Panama, he had to decide, in addition to disputes between officials and departments, such ticklish questions as whether clothes-lines and dogs should be allowed in the town, to what extent Government automobiles and telephones should be used for private purposes, and the apportionment of responsibility in neighborhood spite-wars. In an old community such difficulties are not so likely to arise, or at least they settle themselves, but in a "company town," or where petty officials contend for predominance in various departments, or where contractors oppose inspectors, even a judicial dictator with the ability of Harun-al-Rashid has difficulty in keeping peace.

The psychologists who served the Government during the war suggest that the problem of the future in the administration of industry will lie in conforming routine and bureaucratic machinery so that exceptional individuals—of whom the number is very large—can do the work for which they are fitted under the most favorable conditions. Such exceptional individuals are likely to possess unusual talent behind the unlikeliest-looking and unlikeliest-acting exteriors.

A few years ago, during the reaction against individualism, they were largely disregarded or ridiculed as "cranks," but a broader policy is now becoming evident. It is being realized that many apparently normal people may develop occasional "queer streaks" and evince stubborn prepossessions about trivial matters, and that the handling of such irregularities is going to be of more consequence than might at first appear. We hear of labor strikes nowadays over grievances about eating lunch on company time, or the recognition of a committee, or the attitude of a straw-boss. The executive in most demand, particularly by unpopular corporations, is the man who can adjudicate and "head off" such outbreaks.

The Craze for Standardization

Possibly the curious, often ridiculous, disputes which are occurring in industry are a consequence of too much mechanizing of the habits of human beings. At the end of the nineteenth century there came a reaction against the extreme individualism which writers like Herbert Spencer had made popular, and Americans underwent a craze for standardizing everything that possibly could be standardized. The high point of this standardization campaign was reached in Taylor's efficiency engineering, and while the merit of the application of scientific method to the details of human activ-

ity is well recognized, it is also acknowledged that human beings must be treated like human beings.

Many large companies have established a grievance or welfare or sociological department which aims to keep the employees as contented as possible. These departments appear to have some measure of success, but are likely to be counteracted in influence by the conscious separation of such an attitude as they attempt to foster from the actual operating experience of the daily work. It is as though a man went into a department store and received unpleasant treatment from a floor-walker for which the only satisfaction that could be obtained was an apology from another official whose daily task consisted in making apologies and who had little or no contact with the floor-walker. The obvious solution would consist in employing floor-walkers more capable of understanding and dealing with human beings. Managers and employers might ask, "But how are such floor-walkers to be obtained?" The answer of course, is that they are obtained as anything else is, by making a special and persistent effort to get them and keep them. There could well be a little more trusting to one's intuition, rather than to organization, in the directing of enterprise and in the selection of leaders.

Since it is obvious that everyone cannot be a boss or "a leader of the band," the only consistent way of attaining harmony and loyalty throughout an organization is to put in the positions of leaders only those men who possess the qualities of leadership. The average employee does not object to working under the direction of a man who really is a leader; what he does object to is working under a "bounder" or "two-spot." Most soldiers who served during the war are familiar with the feeling which Arnold Bennett has described as coming to the young subaltern who was marching in a review past a general; the soldier suddenly realized that in the person of the general was that quality of leadership which could induce men to lay down their lives at his order—men otherwise selfish and independent.

We are told that Carlyle's ideas on hero-worship are extravagant, but we should realize that without the hero-worship that is instinctive in the human race democracy would be only chaos and anarchy. It is impossible for employees to feel the least symptom of deference toward many of the industrial officials who are set to direct them. When such misplaced bosses become fairly numerous in mines and factories, an epidemic of unrest and strikes begins. It is an indication that the personal element has been neglected; that positions demanding leadership have multiplied faster than the employers have ferreted out real leaders; that to the wrong men has been given authority over employees, who are quick to detect such mistakes.

Workmen are beginning to realize that they care as much about the personal treatment which they receive in their work as they do about the wages paid. Many men prefer to work for less wages in a position where they are looked upon as human beings than to receive high pay but scant personal consideration under bosses who should be driving trucks or ringing up fares. Man is still a very human individual and there are limits to the power of higher wages. An additional payment of so few cents per hour cannot permanently recompense men for the general lack of consideration for the personal element in employees. Much of the unrest and discontent now so prevalent throughout the country is caused not so much by low wages or long hours as by a neglect of the personal element in industry. This personal element can be supplied, not by the creation of a new department in organization, but by a general change in attitude and policy in the personnel of officials. There are indications that such a change is under way. A franker recognition of the need for it may bring it about more surely and expeditiously.

Garbage Collection and Disposal at Utica, New York

Pickup Made By Trucks With Trailers—Disposal by Feeding To Hogs and Sheep—Methods Employed—Cost of Operation

COLLECTION of garbage by motorized equipment, and disposal by feeding to hogs and sheep, have been employed in Utica, N. Y., and have been found to effect a large saving. The pickup is made by trailers drawn by teams, which in turn deliver the trailers to a motor truck for haulage to the disposal farm outside the city. By means of this system the city is saving about $5000 per year, besides having the work better done. The satisfaction of the public with the new system is evidenced by the large decrease in complaints from property owners.

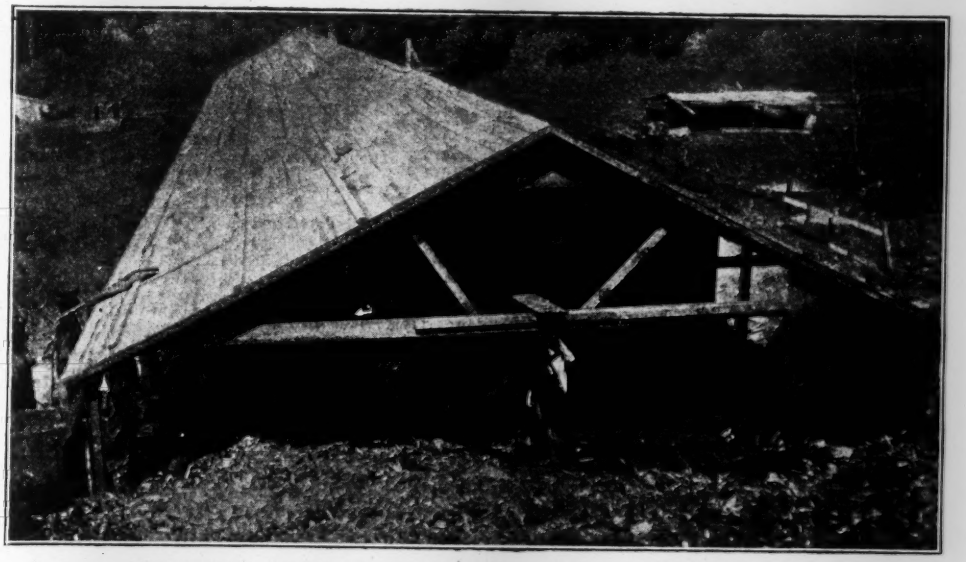
When the old contracts for disposal by reduction ran out April 1, 1919, new bids were taken for the work. The old company, whose contract price for the disposal had been $4100 per year, raised it to $8000, while a new firm bid $3100 for disposal by feeding. With this saving of practically $5000 in view, the city determined to take over the work of collection, and gave the contract for disposal to the low bidder.

For collection purposes the city immediately purchased a new plant consisting of sixteen 3½-yd. side-dump Lee trailers and two 5-ton White motor trucks. Each trailer handles about three tons of garbage, and, when loaded, the trucks handle four trailers over the road to the piggery.

The system used in collection of the garbage is as follows: Eight teams leave the barn at 8 a. m. with one

GARBAGE BEING DUMPED FROM TRAILER TRAIN AT FEEDING FARM

trailer each. These operate over a specified route, taking a different section of the city each day, until the whole is covered. About 10 a. m., the two trucks, each with four empty trailers, start for agreed places of meeting with the teams. Upon arriving the teams exchange their loaded trailers for the empties, and the trucks proceed to the feeding farm while the teams continue collection. The haul to the piggery is about four miles. After dumping, the trucks return for another load.



DUMPING CHUTE AND BREEDING PEN AT FEEDING FARM

Upon arriving at the feeding farm, the loads are side dumped from the trailer down a chute, where the material is picked up by teams and hauled to the various feeding colonies on the farm. The chute is flat and built on an angle of about 45°, with a width equal to two trailers. A view shows a four-trailer train standing at the head of the chute, with one trailer in the operation of dumping. To arrive at the site the trains operate over unimproved country roads, which in some places have grades from 7 to 8%. Little trouble has been experienced in operation at any time.

A large pile of garbage may be seen at the foot of the chute at one end of the breeding pen, where it is loaded for delivery to the various feeding grounds. In collecting the garbage, care is taken that no glass or other substance injurious to the pigs or sheep is included. At the time of instituting the new system the common council passed an ordinance which prescribes heavy penalties for including in the garbage any foreign matter such as glass or tin cans, etc. The ordinance also provides that householders, hotel-keepers, restaurant keepers, etc., must provide proper receptacles and must not deliver their garbage to parties unauthorized by the city to collect it.

Care of the Hogs and Sheep

Great care is taken to keep the breeding and feeding pens in such condition that the animals will not become diseased. The breeding pen shown in the view is divided into small pens about 8 x 12 ft. In these the sows breed and remain with their litters until weaning time. The young pigs are then kept in the breeding pen until they are large enough to take care of themselves, after which they are removed to the feeding colonies in the pasture. One of these colonies, with the small colony houses in the background, is shown. A colony of larger hogs is shown in the foreground of the same view. The garbage for feeding is brought from the chute and deposited in the feeding boxes.

The farm consists of 160 acres, and 1600 pigs are being fed at the present time. Besides the pigs, there is a flock of about 200 sheep, which are being raised on garbage. It was not supposed that sheep would eat refuse of this character, the discovery being made by chance. It is stated by the Commissioner of Public Works that the sheep clean up the garbage fully as well as do the pigs, and appear to thrive on it better.

TABLE I—ITEMIZED ACCOUNT OF HAULAGE AND COLLECTION COST FOR JULY, 1919, AT UTICA, N. Y.

		Total
Tractors		
Operation:		
605 gal. of gasoline at 25½c	$154.28	
2½ gal. of oil at $1.00	2.50	
22½ gal. of oil at $0.56	12.60	
Grease, 20 lb., at 11c	2.20	
Labor, 40 hours at $1.00	40.00	
Repairs: 2 lb. bearings at $2.31	4.62	
Paint	9.40	
Interest	65.00	
Depreciation	216.00	
Insurance	22.53	$529.13
Trailers		
Operation:		
4 gal. of oil at 56c	$2.24	
15 lb. of grease at 10c	1.50	
Repairs, mechanical	34.80	
Painting	31.65	
Interest	152.00	
Depreciation	240.00	$462.19
Harness		
Repairs	$1.20	
Interest	6.00	
Depreciation	20.00	
One new harness	82.50	$109.70
Miscellaneous Tools, Etc.		
Replacements and repairs		$6.55
Horses		
Feed, 176 bu. of oats at 85c	$149.60	
400 lb. of bran at $2.40 per cwt.	9.60	
9,920 lb. of hay	153.87	
45 bbls. of shavings at 50c	22.50	
Veterinary	43.68	
Interest	20.00	
Depreciation	75.00	
Disinfectant	5.00	$479.25
Office Charge		
Printing		34.00
Emergency Truck Operation		
Repairs: 2 new fan belts at 35c	$0.70	
Interest	3.50	
Depreciation	10.00	
Operation:		
92½ gal. of gasoline at 25½c	23.59	
2 gal. of oil at 56c	1.12	
1 lb. of grease at 10c	.10	$39.01
Labor		
Superintendence and inspection	$478.00	
Teamsters and helpers	1,310.12	
Chauffeurs and helpers	336.50	
Cleaners	81.00	
Barn men and superintendent	250.00	
Timekeeper	83.32	$2,538.94
Total for July, 1919		4,198.77
Number of yards collected	1,119	
Number of tons collected	746	
Total unit cost per ton		$5.63

TABLE II. COSTS PER TON-MILE OF MUNICIPAL TRAILERS AND TRACTORS COMPARED WITH PRIVATE CONTRACT METHOD BY TEAMS, FOR GARBAGE COLLECTION AND HAULAGE AT UTICA, N. Y.

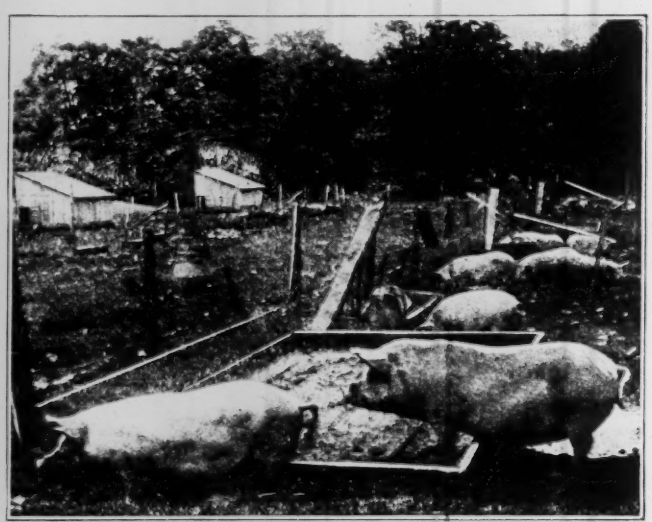
	Month	Tons Collected	Total Cost	Haul in Miles	Ton Miles	Cost per Ton-Mile	Collections per Month	Complaints
Contract method, by teams.	May, 1918	550	$2,328.00	1.6	880	2.64	3	205
	June, 1918	570	2,328.00	1.6	912	2.55	3	77
	July, 1918	600	2,328.00	1.6	960	2.43	3	135
Municipal collection, tractor and trailer system.	May, 1919	738	3,962.48	4.0	2,952	1.34	*8	15
	June, 1919	755	3,935.17	4.0	3,020	1.30	8	24
	July, 1919	746	4,198.47	4.0	2,984	1.40	8	25

Includes $829.96 interest, insurance and depreciation on equipment per month.
* One-quarter square mile downtown area now collected daily.

Equipment	Force Employed and Salaries		Summary
2 tractors	Superintendent	$1,500.00	29% increase in tonnage
	Assistant superintendent	1,320.00	
† 16 Lee 3½-yd. S.D. trailers	Clerk	1,000.00	150% increase in length of haul
	Barn boss	90.00 mo.	
8 teams	2 barnmen	80.00 mo.	166% increase in number of collections
	2 foremen	3.00 day	
1 emergency truck	2 chauffeurs	3.50 day	45% decrease in cost per ton-mile
	2 cleaners	3.00 day	
	18 laborers	3.00 day	85% decrease in number of complaints

†Trailers 4 cu.yd. capacity to water level; our tonnage computed on a capacity of only 3 cu.yd.

In the operation of the truck and trailer apparatus for collection, two men accompany each team and trailer on pickup, and a truck driver and one helper accompany the truck and trailer trains. The men with the teams and trailers and the helper with the truck get $3 per day, while the truck driver gets $3.50 per day. On an average they work six hours, from 8 a. m. to 3 p. m., and pick up from 35 to 40 tons of garbage. These men get straight time. An itemized cost account for collection and haulage for the month of July is shown in Table I. The average cost per ton for May, June and July was $5.40. The costs include a depreciation



GARBAGE-FEEDING COLONIES IN THE PASTURE

and renewals of plant. Table II, shows a comparison between collection and haulage to the disposal plants by the old method and the new method by trucks and trailers. Large increases in material hauled, efficiency and satisfaction are indicated—this with an increased haul. The general satisfaction is shown by the greatly decreased number of complaints. While there was considerable complaint against the reduction plant used heretofore, no complaints have been lodged against the piggery. During August, 1918, 500 complaints were recorded, and it was not uncommon to have 260 complaints per month. Under the new system 26 has been the maximum for any one month. It is intended to instal a similar system for ash collection as soon as the contract for that runs out.

The system has been put in operation under H. R. Hayes, commissioner of public works, A. J. Armstrong being superintendent. The former contract for disposal by reduction was with Harry Stappenbeck & Sons, who were engaged in the manufacture of fertilizer, while the new contractor is Sauer & Hameline.

Supervision of Public Water-Supplies by the State of New York

By Theodore Horton
Chief Engineer, New York State Department of Health, Albany

Abstract of Paper Read Before New England Water Works Association

THE public water-supplies of New York State are under the supervision of the State Department of Health as regards quality and under the State Conservation Commission so far as legal and certain engineering questions are concerned. This paper deals with matters of quality.

About half of the 12 full-time engineers in the State Department of Health give practically their entire working hours to public water-supplies.

From 1886 to 1907 the typhoid death rate in the state averaged 23.1 per 100,000 and had its ups and downs. For the period 1908-19 the rate averaged 11.3 and declined almost continuously, falling to about 5 per 100,000 in 1918. The curve is now so flat as to indicate comparatively little further average decline, although the high rates which still prevail in some cities will afford plenty of work to do for some time. It may be noted, however, that of the approximately 530 water-works, supplying 8,500,000 persons in 1919, some 130, furnishing water to a population of 6,900,000, treat the water in the same way.

Chlorination alone is not a safe reliance, largely because of the impure liquid chlorine now being supplied, which causes stoppages by clogging. Of a hundred chlorination plants in the state, half get out of order from time to time.

American Ships Built Since Armistice

During the 12 months which ended Nov. 1, 1919, American shipyards turned out 2395 vessels, of 4,258,045 gross tons, officially numbered by the Bureau of Navigation, Department of Commerce. These figures, included in a recent issue of *Commerce Reports*, indicate that during that period American shipping gained approximately 85 per cent. over the similar 1917-1918 period.

Continuing a series of interviews with contractors:

Construction Labor's Instability

An Analysis—

II—In Which W. P. Schmuck of the Degnon Contracting Company Suggests Changes in Immigration Legislation as a Remedy for the Shortage of Labor

IN the judgment of W. P. Schmuck, secretary of the Degnon Contracting Co., New York City, contractors face a labor crisis unprecedented in construction history. That crisis, in his opinion, is due to the labor shortage caused by a closed door to immigration and the exodus of men of foreign extraction to their former homes, unvisited for many years. Mr. Schmuck believes the labor shortage to be so acute that large stable industries will, in time, absorb all the common labor, leaving high and dry the contractor who cannot guarantee, as can these large industries, yearly employment. So thoroughly does he believe that immediate remedial measures should be applied that he has employed much of his own time in the attempt to secure data which will be convincing to Federal lawmakers.

Mr. Schmuck's discussion of the labor situation, of which the above is a summary, reveals a close personal contact with its radicalism. He ascribes labor's restive spirit to a combination of causes, though the shortage of labor is the chief contributing factor. In all his dealings with labor the radical element, a decided minority, has held the whip hand. Take, for instance, subway construction in which the Degnon Contracting Co. has wide experience where the majority of labor used is Italian. Mr. Schmuck asserts that labor, in the main, may entirely refrain from open acknowledgment of union affiliation, but when a strike is imminent the radical leaders, through intimidation of the laborer or his family, usually control the situation. Such intimidation and the laborer's inherent dislike for the term "scab" or "strike-breaker" are the great aids to the union business agent in bringing about a strike. In many cases, laborers are not positive strikers. When a strike is called they remain at home to insure the safety of their families and to avoid the stigma attached to strikers' characterizations of non-unionists.

Radicalism Growing

As an example of the increasing radicalism of labor he cites the following paragraph, which is section 5, article VIII, of the working rules for Local 1456, Dock and Pier Carpenters, and which is incorporated in their agreement with the Contracting Dock Builders' Association for 1920:

"Any foreman who uses abusive language or rushes men under his supervision shall be fined $25, ruled off the job, and not allowed to act as foreman for this employer for one year. Where discrimination is charged, reasons must be given and in case the charges are proven no members shall be permitted to work for the employer."

Granting that there is a great deal the matter with labor, Mr. Schmuck is more concerned with measures of relief. He accepts the existence of a crisis which demands immediate application of remedial measures. To meet this crisis he has more than theory. He has in mind a well-developed course of action on which he has spent considerable time and thought. He gives it to us for what it is worth. Realizing that the labor shortage is the underlying cause of labor unrest, he has formulated a plan of attack whereby he would convince Congress of the necessity of passing immigration laws which will allow the absorption by the American contractors of adequate foreign labor. Facts and figures must be exact to be compelling, otherwise Congress will, with little investigation, drop the contractors' plea that immigration be permitted. His plan is therefore comprehensive and is, essentially, susceptible of division into two main heads.

The first of these two divisions involves a census of industrial labor and that used on construction work in enough centers of population or seats of industrial and construction activity to give an adequate relation between labor supply and labor demand. The second part of his plan contemplates a canvass of American ports to discover the extent of the exodus of Americanized Europeans to their former homes, and the number of newly arrived immigrants. Through the combined information as to the exact shortage of labor, and the extent to which labor is returning to foreign soil, Mr. Schmuck believes he would be able to produce such convincing figures as to force the most careful consideration by Congress of his plan for limited immigration.

Sources of Information

Two sources, from which could be secured information as to the exact labor shortage, and the balance between emigration and immigration, present themselves to Mr. Schmuck. They are the United States Chamber of Commerce, through its constituent members, and the United States Department of Labor. Though the former might produce results the more quickly, it is believed that, inasmuch as the several congressional immigration committees would doubtless be more impressed by reports emanating from Federal agencies, a labor balance sheet would probably secure more thoughtful consideration if all the facts and figures contained in it were expressions of the Federal Department of Labor, or some other authorized agency for the accumulation and dissemination of such data.

Mr. Schmuck believes that were true conditions in Europe made known to those men who are daily returning to European soil, many of them would hesitate to leave the United States. He believes that, generally speaking, the Americanized foreigner, returning to his former home, has little knowledge of the living conditions that he will meet across the Atlantic, although in a measure the social and economic turmoil has been indicated to him by those of his friends who have made this transatlantic trip. In order fully to inform prospective voyagers as to exact conditions in those countries which they intend visiting, Mr. Schmuck advises the establishment of information bureaus at ports of embarkation and at such places where passports must be applied for. He also suggests the distribution of information concerning living conditions in European countries through foreign language press reports. All this information would be devoid of colorful detail and would not be given out with the idea of creating prejudice.

Mr. Schmuck has already gone so far as to write to

certain members of Congress indicating that the most careful consideration must be given legislation concerning immigration. A reply to one of these letters, written shortly after the armistice, contained an oft-repeated argument, the fallacy of which Mr. Schmuck wishes to expose. This particular Congressman asserted that the then apparent shortage of labor would be corrected when the American Expeditionary Forces were returned to American soil. Such a view, asserts Mr. Schmuck, does not take into consideration the fact that the poorest man in the American Expeditionary Forces would not do subway construction work. Firms such as the Degnon Contracting Co., which specialize in that class of construction, must therefore count upon other than ex-soldier labor. Mr. Schmuck has also written to chambers of commerce and similar bodies in the hope of securing information as to the extent of the labor shortage in certain centers, as well as the extent of the exodus of the Americanized foreigner.

Mr. Schmuck believes in his plan. He believes in it to such an extent that he has utilized a good deal of his own time, although his duties in connection with the Degnon Contracting Co. are extensive, in perfecting it and in endeavoring to secure information which will be convincing to members of Congress. He is thoroughly alive to the dangers that lie in the enactment of such legislation as will permit of the wholesale immigration of radical foreigners. Nevertheless he believes in the possibility of the passage of such immigration laws as will allow entrance to the sane and industrious foreigner. He believes that the United States could readily absorb all the sane laboring element that the recently war-ridden European countries could allow to leave.

Like many of his associates, Mr. Schmuck believes that all incidental difficulties would be eliminated were the labor shortage to be corrected. He pleads for correction through adequate immigration legislation. Without it he sees the possibility of stabilized industries absorbing all common labor, leaving the contractor stripped of working forces. The execution of his plan for a labor survey he finds makes greater claims upon his time and energies than he can afford to give. He frankly admits the immensity of the project, and he asserts that the individual or organization or agency which carries these ideas into successful execution will have done the greatest possible service to the American contractor.

Typhoid Suit Over Rochester Dual Water-Supply

The dual water-supply at Rochester, N. Y., has given rise to a suit against the city for typhoid damages. The suit, after being dismissed by the trial court for lack of evidence, has been remanded for jury trial by the New York Court of Appeals (Stubbs vs. City of Rochester, 124 N. E., 137). For decades Rochester has been the only city of any size in this country, and almost the sole city, to maintain a separate water-supply for ordinary fire protection and for street sprinkling, the water being pumped from the Genesee River. The plaintiff alleges that mixture of the fire protection and potable supplies caused him to have typhoid, and he brought suit against the city for damages. The evidence indicated that during the period of mixed supply there was more typhoid in Rochester than usual and that typhoid was contracted by many who drank the mixed water. The city health officer testified that in his opinion the mixed water caused the case of typhoid in question. The defendant city claimed that the case was not proved, with the result already stated.

Flood Protection and Drainage at East St. Louis, Illinois

City, Industrial and Farm Areas Protected From Mississippi and Hill Streams by Levees, Channels and Large Pumps

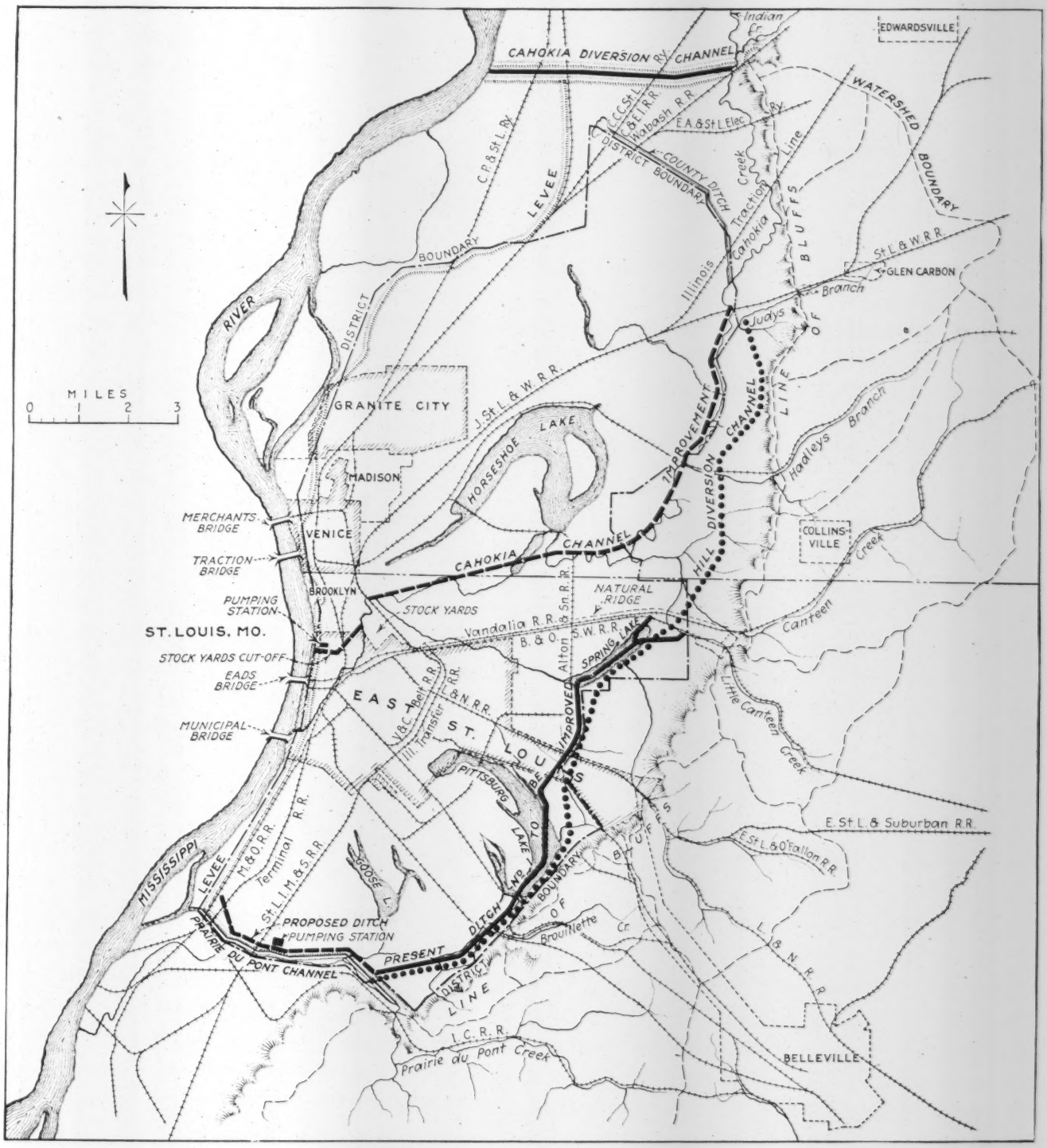
REMOVAL of drainage waters and control of storm waters through the low lands along the Illinois side of the Mississippi River, opposite St. Louis, Mo., by means of channels, pumping stations and the use of lakes as reservoirs during exceptional floods, are the recommendations of a recent report made to the East Side Levee and Drainage District by Alvord & Burdick, consulting engineers, Chicago. These lands, known as the American bottoms, were subject originally to flooding by the Mississippi River and by storm waters from numerous streams flowing down the steep bluffs which form the eastern boundary of the bottoms.

About 12 years ago the above-named district was organized, for the protection of an area of about 96 square miles, having a length of nearly 20 miles and a width of about five miles from the bluffs to the river. Since then a channel has been cut across the north end of the district to carry the flood waters of Cahokia Creek, the largest of the hill streams, which formerly followed a circuitous route through the district to an outlet in the City of East St. Louis. A system of levees also has been built, extending along this channel, down the river front and back to the bluffs. These works and the flood-control problem were described in *Engineering News* of Feb. 2, 1911, p. 132; Aug. 28, 1913, p. 432, and Feb. 5, 1914, p. 300. The present report deals with the control of water falling upon the district and coming into it from the smaller hill streams, which latter have a drainage area of about 81 square miles, but it touches also upon the possible requirements for improving the existing flood channel and levees.

Seven Cities and Much Farm Land Included

The drainage district includes a group of seven cities and extensive railway and manufacturing interests, but about 90% of its area is farm land, a considerable area of this being useless at present on account of insufficient drainage. The present population is about 140,000; it is estimated that it will reach 400,000 by 1950. This is largely within East St. Louis, Ill., which, as shown by the report, has grown in 10 years to become the second city in the state, owing to its importance as a freight terminal and as a location for industries dependent upon shipping facilities.

Storm waters now to be dealt with are those from the 81 square miles of drainage area in the hills and the 99 square miles of drainage from the bottoms, which find outlets through Cahokia Creek and Prairie du Pont Creek, shown on the accompanying map. During heavy storms the water accumulates in the lakes, and flows gradually away through the creeks, but with the river at the 20-ft. stage at the Eads Bridge, corresponding to 407.1 United States datum, the flood gates at the mouth of Cahokia Creek are closed and the accumulated waters must remain until the river recedes. A low ridge extending from the bluffs to the river and occupied by the Baltimore & Ohio R. R. divides the district into two sections, connected by some culverts. The lower section is still subject to flooding by backwater



PRESENT AND PROPOSED WORKS FOR FLOOD PROTECTION OF 96 SQUARE MILES AROUND EAST ST. LOUIS, ILLINOIS

from the river, as the Prairie du Pont levee on the south boundary has not been completed to the bluffs. The old channel of Cahokia Creek extends through a congested industrial district of East St. Louis, where it is restricted by numerous railway bridges and embankment, while it creates a nuisance by taking the sewage and trade wastes of the packing-house section.

Run-off from the bottoms is influenced largely by storage in the lakes and ponds, and by ponding at the numerous railway embankments, which are well above the interior flood plane. Storage capacity of about 400,000,000 cu.ft., 540,000,000 cu.ft. and 2,700,000 cu.ft. at El. 410, 415, 420, respectively, is provided by the lakes and low ground.

Maximum flood heights in the Mississippi reached El. 428.5 in 1844 and 425.1 in 1903, while the low water plane is 387.1 United States datum at the Eads bridge. With the completion of the Prairie du Pont improvements the district will be inclosed by levees corresponding to El. 433 at the bridge. The lowest parts of the district are at about 402, while the major portion lies between El. 420 and 430. After the great storm of Aug. 20, 1915, water was ponded in Horseshoe Lake, the lowest part of the district, to El. 417.64, and though

the river fell rapidly the land was not cleared of the surplus accumulation for about 16 days. The records of this storm show a rainfall of 6.85 in. in one day and 7.29 in. for two days.

As to the method of drainage, the engineers conclude that the best way is to handle both local rainfall and storm water from the hills by carrying it through the district to the river. They consider it economical so to drain the bottoms that farming can be carried on to the normal low-water lines of the lakes, as damage to crops on the lowest ground will occur probably only one year out of 10. It will be economical so to design the outlet works and pumping plants that in such exceptional storms as that of 1915, occurring probably only once in 50 years, the lakes and adjacent low lands would be flooded for from 2 to 15 days up to a maximum of El. 414, United States datum.

Three 12-Foot Conduits Proposed

Improvements recommended in the report include two main sections. For drainage of the northern part of the district and elimination of the nuisance from stockyard wastes, a reinforced-concrete conduit 6600 ft. long is to extend east from Cahokia Creek to the river. This would have three channels 12 ft. in diameter, with a combined flow capacity of 2000 sec.-ft. It is explained that a single 20-ft. conduit would be more economical, but that its lower portion would be in wet ground below ordinary low-water stages of the river, while with the triple conduit the excavation will be mainly in the dry and the top elevation will be sufficiently low to provide good drainage. At the river end there will be controlling gates and a pumping station having a present capacity of 1000 sec.-ft., this capacity being increased as required. Larger and smaller conduits were considered. but the 2000 sec.-ft. capacity was decided upon as meeting the flood conditions most economically. Larger conduits would be of unduly high cost, while with smaller ones the run-off would be so slow that water would remain on the land long enough to kill crops.

For the southern section of the district it is proposed to enlarge and extend the present main ditch, connecting it with two lakes and providing an outlet of 1000 sec.-ft. capacity through the Prairie du Pont levee near the St. Louis & Iron Mountain R. R. At this point there would be a pumping plant having a present capacity of 500 second-feet.

Large Centrifugal Pumps Required

Pumping at these stations would average 52 days per year, records indicating variation from zero to a maximum of 130 (in 1915). Most of the discharge would be against the relatively low stactic head of 7 to 12 ft. For a few days it might reach 15 ft., and even 21 ft. in exceptional floods. The report states that centrifugal pumps as large as any yet manufactured would be required; probably six 72-in. and two 42-in. pumps for the eventual 2000 sec.-ft. capacity of the larger station. Electric operation is assumed on the basis of lower cost for plant and operation than under any other power.

A summary of the cost estimates follows:

Cahokia Creek conduit	$1,284,000
North pumping station (1000 sec.-ft.)	450,000
Ditch and outlet conduit	300,000
South pumping plant (500 sec.-ft.)	250,000
Total	$2,284,000

An alternative method of handling the hill drainage is to carry it outside of the district to a diversion channel for gravity flow to and through Prairie du Pont Creek, as shown by the map. The creek, as improved by levees, has a capacity for 200 sec.-ft. per square mile, which is ample for all the hill drainage, and the channel preferably would have this same capacity. Its slope would be about 1½ ft. per mile, giving a maximum velocity of 5 ft. per second. The channel would be about 17 miles in length, with some heavy cuts, and having a levee on the west side to prevent river floods backing up into the channel from overflowing into the district. The low land between the levee and channel and the hills would provide ample area for occasional heavy floods and storm waters, the flooded width varying from 500 to 2500 feet.

This diversion channel would serve about 45% of the drainage area and relieve the bottom lands of 40% of the water now reaching them and to be handled by the works described above. With outlets of the capacity noted, for these latter works, however, this relief would not materially improve the interior conditions during the floods of 10-year intervals, while in the exceptional 50-year floods the maximum water level in the district would be only 2 ft. to 3 ft. lower than that provided by the plan recommended, protecting an additional 7700 acres in such storms.

This diversion would reduce the operating expenses of the pumping plants, but would involve higher cost of maintenance for the diversion channel than for the main ditches in the bottom lands. Its cost would be about $1,072,500, while in the plan recommended the proportion of cost due to the hill drainage is about $912,000. In the possible event of municipal development on the low lands, the diversion channel might be warranted as an additional precaution in the future.

As to capacity of the main ditches, it is considered that they should be proportioned to carry off a rainfall of ½ in. in 24 hours over the area tributary to them. They would be of larger capacity where the hill drainage enters the bottoms, in order to remove the flood flow rapidly. Ordinary rainfalls would be carried in the ditches at such a level as not to injure crops on the adjacent lands, while storage in the low spots would be utilized so as to cause the least damage under exceptional storm conditions.

The adequacy of the existing works to exclude floods of the Mississippi River and Cahokia Creek is an important point dealt with in the report. Property values in the district are high and likely to increase, so that there should be assurance of ample protection. In the 1915 storm the present Cahokia Creek diversion channel at the north end of the district was filled practically to capacity, while rainfalls of that period on the west side of the river indicate the possibility that the drainage areas of the creek and the East Side district may be subjected to still heavier rainfalls. Under such conditions, and in view of the disastrous consequences of levee failure on the river front, especially if near any of the towns, the engineers recommend that study be made of the safety of the existing levees, in view of the possibility of a higher future flood plane.

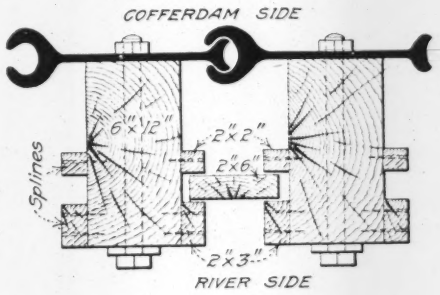
Assistance in the form of surveys, maps and records was furnished to Alvord & Burdick, for the purpose of this report, by E. F. Harper, consulting engineer, and W. E. Putman, chief engineer of the East Side Levee and Drainage District.

New Type of Thin-Wall Cofferdam

Combined Steel and Timber Piles Form Sectional Design Giving Low-Cost, Stiffness and Water-Tightness

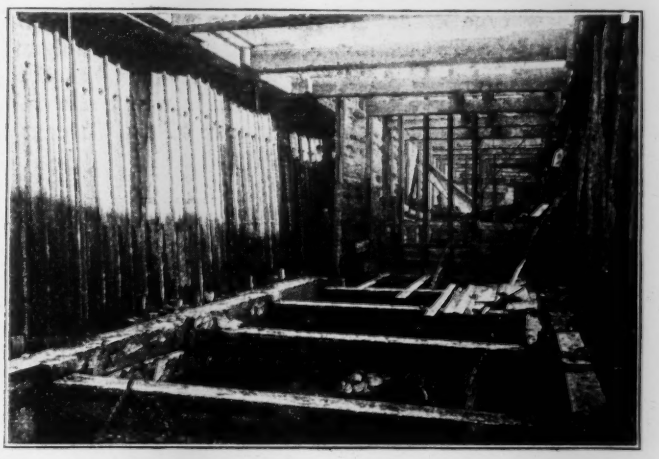
A SECTIONAL type of cofferdam, designed to combine the advantages of steel sheeting and puddle-wall construction, is a new development employed in building the concrete bulkhead wall along the river front of the site of the new union station, Chicago.

In this design the wall of the cofferdam consists of individual piles, each composed of an interlocking steel



COMBINATION PILES FORM THIN-WALL SECTIONAL COFFERDAM

sheet pile having a heavy timber secured to the outside of its web by bolts spaced about 7 ft. on centers. Wood splines are spiked to the sides of the timber, as shown in one of the drawings. After these combination piles have been driven for any desired length of



COFFERDAM HAS STIFF WALL REQUIRING BRACING ONLY AT TOP AND BOTTOM

wall, the spaces between the timbers are closed by driving vertical planks in the grooves formed by the splines. In this way a closed pocket is made in front of each joint in the steel sheeting, so that any leaks are isolated and can be closed by filling the pockets with sand, sawdust, cinders or other material.

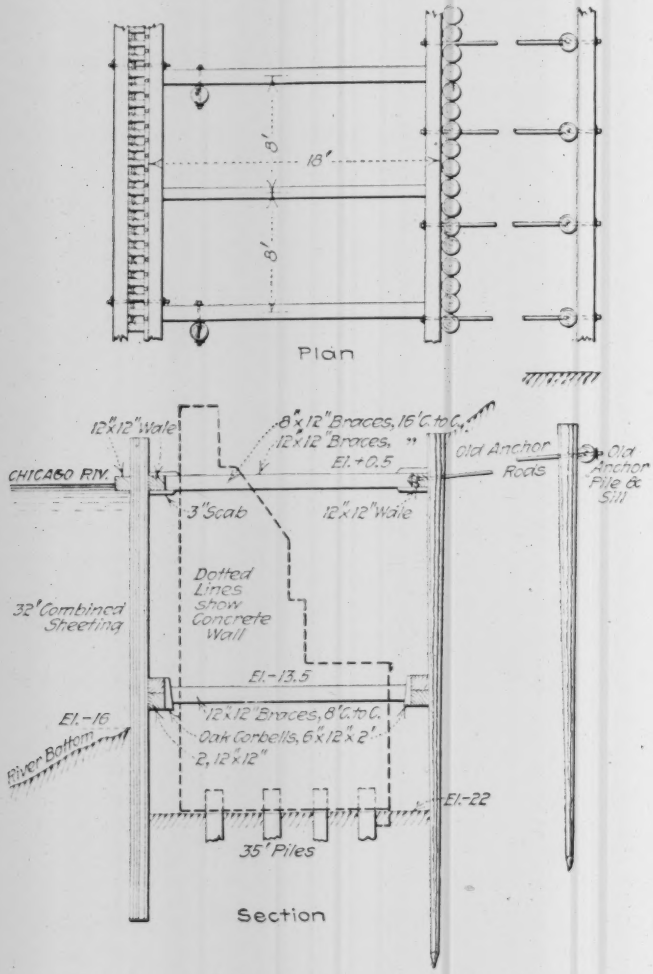
This construction provides a thin but stiff and water-tight wall, the stiffness of which makes it possible to use less bracing than is usually required, and this reduces the obstruction to the work within the cofferdam. The narrow width is of particular importance for work in navigable waters. In cost, speed and facility of driving and pulling the piles, this construction is approximately equal to a single line of steel sheeting, while it is considered to have advantages over the puddle-wall type of cofferdam in cost, amount and salvage of material and time required for construction and removal.

Pumping down the water to a depth of 13 ft. before placing any lower bracing was practicable on this Chicago River work, owing to the stiffness of the cofferdam. This enabled all bracing to be placed in the dry, instead of being submerged in advance of lowering the water level. On this work the excavation is 18 ft. wide and 22 ft. deep below the surface of the water. The river wall is built in the manner described above, while on the land side are the old bulkhead piles or a single close row of round piles which are tied to the anchor piles of the old timber bulkhead wall.

Only two sets of bracing are required, one of these being a little above the water line and the other 13 ft. below this, or 9 ft. above the bottom of the excavation. For the lower bracing, double wales are used to give additional resistance.

CHICAGO RIVER COFFERDAM WITH THIN BUT WATER-TIGHT WALL

This new type of cofferdam construction is the invention of John F. Cushing, assistant general manager of the Great Lakes Dredge & Dock Co., which has the contract for the river wall. The work is under the direction of J. d'Esposito, chief engineer of the Chicago



COFFERDAM CONSTRUCTION FOR BULKHEAD WALL ON CHICAGO RIVER

Union Station Co. All piledriving, excavation and concreting are done by floating equipment.

For future construction operations modified designs of the combination piles have been worked out to meet various conditions. In hard ground, where the driving of the large timbers would be a difficult matter, it is proposed to use I-beams riveted to the sheet piles. Angles riveted to the webs of the I-beams would serve to hold the stop or closing planks, which would be driven in grooves formed by the angles and the flanges of the I-beams.

A Long-Range Transit

A surveyor's life is not all pleasure. H. L. Brightman, engineer of surveys, Michigan State Highway Department, makes the following observations in the *Proceedings of the Michigan Engineering Society*: "Foolish questions are also a nuisance. One in particular I have often been asked by a bewhiskered native is, 'How fer kin ye see with the durned thing?', meaning the telescope. You might as well take a short cut and tell them you can see the sun 91,000,000 miles away. This generally precludes further interruption. 'Tis a glorious life."

Insulation Resistance in Motors Reduced by Moisture

By W. W. Brush
Deputy Chief Engineer, Department of Water Supply, New York City

Moisture, aided to some extent by natural deterioration from old age and infrequent operation, was responsible for the burning out of a number of the electric motors which drive the high-pressure fire-service pumps in New York City. The pumps are six-stage, centrifugal machines having a capacity of 3000 gal. per minute against a pressure of 300 lb. per square inch. They are driven by 6600- and 6300-volt induction motors. Under normal conditions of operation a motor is started on receipt of a fire alarm and stopped when the Fire Department notifies the pumping station that no further supply is needed.

In 1917 there was a fire in Brooklyn and after the pumping station had been in operation for about 48 min. one of the motors burned out. A second motor was started and ran for 40 min., when it burned out; a third motor was started and ran for 66 min., when it also burned out. The fourth motor finished the run on this fire, which required it to be in operation about 45 min. An examination showed that the insulation of the stators had failed and would have to be rewound.

After the repairs were made tests of the insulation resistance were made. Inquiry of the manufacturers showed that they considered that a minimum of five megohms resistance was necessary for safe operation, although operating men of experience expressed the opinion that two megohms would be sufficient. To eliminate moisture, the machines were baked and varnished, but eight months later the insulation resistance dropped to slightly under two megohms on days when the weather conditions were unfavorable. The motors absorbed moisture from the air in sufficient volume to lower the insulation resistance to a dangerous degree.

To prevent deterioration by moisture, it was decided to try various devices, such as covering each motor with a canvas housing and applying heat with a small steam coil at the base of the motor frame. Consideration was given to the use of unheated air dried by means of a special electric fan or blower, and this method offers interesting possibilities which may later be tried out by tests, but for the present the drying of the air by heating seems to be the surest method in its results.

Milwaukee Water Siphon Under River a Difficult Job

An inverted siphon for carrying water under the Menomonee River at W. Water St. in the City of Milwaukee is now being constructed. The barrel of the siphon, according to T. Chalkley Hatton, chief engineer of the Sewerage Commission, is to be about 100 ft. below city datum and composed of a concrete ring 60 in. in diameter, inside of which is to be laid a 30-in. cast-iron hub-and-spigot pipe. One caisson shaft has been sunk to subgrade and vertical air locks installed. The other caisson shaft is now being sunk with considerable difficulty, owing to obstructions encountered in the form of old timbers, piles and marine wreckage. These caissons consist of steel rings lined with concrete, built on the surface in 6-ft. sections and sunk by their own weight, assisted occasionally by hydraulicking around the cutting edge.

Bituminous Concrete and Brick Roads for Indiana

New State Specifications for Brick Paving and Bituminous Paving on Concrete Base—Special Brick on Grades

CEMENT concrete, bituminous concrete and vitrified brick are the three types of highway paving provided for in the new specifications of the Indiana State Highway Commission. The first two of these types are included in work now under construction, with cement concrete in the majority of cases, as noted in *Engineering News-Record* of Sept. 4, 1919, p. 488. In all cases the paved width is 18 ft., with a 2-in. crown. The specifications were prepared under the direction of H. K. Bishop, chief engineer of the commission, and an abstract of those for concrete paving and preparation of road-bed was given in *Engineering News-Record* of Sept. 25, 1919, p. 614.

Bituminous-Concrete Roads

This construction includes a 1½-in. wearing course and 1-in. binding course on a 6-in. concrete base, the base being extended upward at each side to the finished level of the paving so as to form 6-in. curbs 2½ in. high. Asphaltic cement for this surfacing is to have a penetration of from 50 to 75, but generally between 60 and 63, the requirement being varied by the engineer according to the kind of asphalt that is used. At 77° F. the penetration must be at least 50% of the above limits. Loss by volatilization must not exceed 3% by weight of the bitumen, and the ductility test must show an elongation of not less than 60 cm. for material having a penetration of 50 at 77° F. Increase or decrease of 2 cm. will be allowed for each five points above or below the 50 penetration.

Mineral aggregate for the binder includes stone and sand passing a 1-in. screen and a ¼-in. sieve, respectively, but slag may be substituted for stone on approval. Of the total mineral aggregate, 15% to 65% must be of 1-in. to ½-in. size and 20% to 50% from ½-in. down to a No. 10 sieve, while 15% to 35% must pass this sieve. Sand and stone heated to between 225° and 325° F. are measured separately, and then mixed with asphaltic cement to produce a mixture containing 15% to 25%, by weight, of material passing a No. 10 sieve and from 5% to 6% of bitumen.

For the wearing course the mineral aggregate includes ¼-in. to ½-in. stone, stone-dust or portland cement, fine sand not exceeding 4½% of the total mixture and the mineral dust contained in the refined asphalt. The stone dust must all pass a No. 50 sieve and at least 67% must pass a No. 200, while all the sand must pass this latter sieve. The final mixture is to contain 9% to 12% of bitumen, as directed by the engineer, with other parts as follows: 5% to 10% of ½-in. to ¼-in., 5% to 15% of ¼-in. to a No. 10 sieve, 7% to 25% of No. 10 to No. 40, 11% to 36% of No. 40 to No. 80, 10% to 25% of No. 80 to No. 200, and 10% to 14% passing a No. 200 sieve.

Before mixing, the three materials are to be heated to about 300° F., not exceeding 375° F. for the sand and stone at the mixer or 325° F. for the asphaltic cement at the discharge pipe. After the sand and stone are mixed the stone dust or cement filler is added, the asphaltic cement being then poured and the mixing continued for at least 1 min. It is required that the asphaltic cement be measured at all times by weighing with scales attached to the bucket, while stone, sand and stone dust must be weighed also, unless an approved method of gaging is used.

In laying the binder course, it is to be at a temperature of 200 to 325° F., spread and rolled to a 1-in. thickness with a tandem roller of at least eight tons, working at a rate of not over 300 sq.yd. per hour. Hot tampers of 25 lb. weight and not over 48 sq.in. in area are specified for use within 8 ft. of structures. This binder course must not be laid for a greater distance that can be covered by the next day's output of wearing surface and no traffic must pass over the binder.

For the wearing course, a temperature of 250° to 280° F. is required, according to the asphalt used. It is first rolled with an eight-ton tandem roller having a main roll of such width as to give about 250 lb. per inch of tread, the rolling not to cover more than 200 sq.yd. per hour, while a 10-ton roller is required for the final compression. Tamping is done as above. Contact surfaces of structures, curbs and joints are painted with asphaltic cement. After ironing all projections, joints and honeycombed areas, portland cement is swept over the surface. Traffic must be excluded for at least six days.

Brick Paved Roads

This construction provides for 4-in. vitrified blocks with cement grouting, laid on a ¾-in. cement-sand bed over a 4-in concrete base. For the bedding course, a 1:4 dry mix is used, made by a batch mixer or by hand. This is compacted by a hand roller not less than 36 in. in diameter and 24 in. in width, weighing 10 lb. per inch width of tread and having a 12-ft. handle.

Bricks must not lose more than 22% of weight in the rattler test, and "hillside" blocks are required on grades of 5% or over. The surface of the brick paving is to be rolled with a tandem roller of three to five tons, working first transversely and then at 45° in the opposite directions. Hand tampers on 2-in. boards are to be used at curbs and inaccessible points. Grouting must follow the paving closely, using a 1:1 hand mix or 1 : 1½ machine mix, the grout for the hand mix being spread with scoop shovels and swept over the paving. Any open spaces are to be filled with a thicker grout, and the paving finished to a smooth surface with squeegees. With paving of hillside blocks, the grooves are cleaned out when the grout has taken its initial set but is still soft, the pavement being then swept clean.

Expansion joints ⅜ in. thick, of the premolded type, are to be placed adjacent to street-car rails. Testing the finished surface is to be done with a 10-ft. straightedge, all depressions exceeding ¼ in. being corrected. After inspection, the surface will be covered with ½ in. of sand, to prevent too rapid drying of the grout filler, this being sprinkled three times a day when the temperature is 75° F. or over. Traffic must not be permitted for at least 10 days, the sand covering being removed before the road is opened.

Concrete Base For Paved Roads

Concrete for the 6- and 4-in. bases of bituminous and brick paving, respectively, is made with crushed stone, slag or gravel, graded from a maximum size of 1½ to 2 in. down to ¼ in., not more than 5% of the material passing a ¼-in. screen. Stone must have a French

coefficient of wear of 8. Slag must have been air-cooled and exposed to the weather and must weigh not less than 75 lb. per cubic foot when dry and shaken. Gravel must be washed.

The mix is specified as 1 part cement to 9 parts total aggregates. This will approximate 1 : 3 : 6, but the fine aggregate must not exceed 50% of the volume of the coarse aggregate, while 7 cu.ft. of concrete in place must contain 94 lb. of cement. The cylinder test for consistency allows a vertical settlement of 4 in. in a 6 x 12-in. column of concrete when the cylinder is removed. A mixer of the batch type is required, with a minimum time of 1 min. at 14 to 20 r.p.m. Timing and measuring devices are not specified, as in the case of concrete paving (see *Engineering News-Record* of Sept. 25, 1919, p. 614). Hand mixing is permitted in batches not exceeding ½ cu.yd. No expansion joints are used. Bucket placing is not specified, as for concrete paving, but the concrete must be deposited by a "discharging device which does not cause segregation of the mortar and coarse aggregates."

Forms may be of wood or metal and must be set to line and grade for 200 ft. in advance of the concreting, their faces being cleaned and soaped or greased. Concrete must not be made when the temperature is at 35° F. or below, nor may materials containing frost be used. During hot weather, the concrete is to be sprinkled for at least three days after placing, while during cold weather, when the temperature may be expected to reach the freezing point, it must be covered with fodder, straw or stable manure.

Concrete base for bituminous concrete paving must be given a moderately rough surface, with the coarse aggregate well embedded but not coated with mortar, while for block paving the surface must be brought to a smooth finish. The specifications state that the concrete shall be brought to the required grade "by means of a templet, straight-edge or the backs of shovels."

Large Production of Synthetic Cast Iron

Over 150,000 tons of "synthetic cast iron," made from steel turnings, were produced in France during the war by a single company operating three works, according to information given by C. A. Keller at a meeting of the Iron and Steel Institute in September, 1919. The process involved is one in which the steel turnings are melted in an electric furnace in contact with coke. To reduce the conductivity of the mixed charge of turnings and coke, and at the same time to desulphurize the metal, basic slag is mixed with the charge. As the mass is heated by the electric current passing through it, carburization of the iron begins well before fusion, but goes on much more rapidly as the melting temperature is approached. Complete carburization is attained upon melting. The silicon content of the metal may be kept practically unchanged. Working the electric furnace by continuous charging, the consumption of electrical energy has been reduced to as low as 675 kw.-hr. per ton of pig, in a 2500-kw. furnace of 80 to 100 tons capacity per 24 hours. In case the raw material used is undesirably high in phosphorus, it is necessary to resort to duplex working, dephosphorizing in an electric furnace, with partial carburization, and then carrying out the remaining carburization in an open furnace. The power consumption is more than doubled in this case, but an iron of a very high degree of purity may be produced.

Federal Purchase of Railroads at Fair Value

MEANS to be employed in effecting the "acquisition by the Government of the railroads of the country at their fair value," as outlined in the article on "A Plan for Private Operation of Federalized Railways," published in *Engineering News-Record* of Sept. 11, 1919, p. 496, have been presented in some detail by the author of the article, Col. William J. Wilgus, consulting engineer, New York City, in a letter replying to an inquiry on the subject.

After pointing out that the determination of fair value must be faced in every other railroad plan so far advanced, Colonel Wilgus states a preference for making such a determination on a basis of capitalized net income for the "test period," 1915-1917, rather than on a basis of stock market quotations, physical valuation or investment cost. In outlining the manner of Government purchase, it is stated that the problem is primarily one of how the Government will raise the annual sums required for a proper return on railroad investment, rather than whether the capital involved is represented by a corporate or a Federal security.

The letter follows:

You ask how the Government can be expected to arrive at a fair value of the railroads, and how the Government would get the money to pay cash for such portion of the purchase price as the owners might elect so to receive in lieu of Government securities.

Before attempting to answer these queries I should like to call your attention to the fact that they apply not only in the case of the plan we are discussing, but also with equal force in the case of every other plan that has been so far advanced.

To determine the adequacy of fair rates, fair value must be known, and this means that in some manner the fair value of the railroad properties of the United States must be arrived at, whether the ultimate solution is to be attained through private or public ownership. Therefore, we cannot escape dealing with this situation face to face.

As to the manner in which the Government will raise the money with which to finance the transaction, this, in the final analysis, resolves itself into the question of how the Government will raise the annual sums required for a proper return on capital invested in the railroads of the United States. In other words, annual income is the point at issue, regardless of whether the piece of green paper which represents the title of the holder to a share in such annual income has engraved upon its face the name of a corporation or the name of the Government. As you know, in France securities are purchased on the basis of annual income rather than on the principal. In a nutshell, the question of financing primarily rests on the raising of an annual income directly or indirectly to be guaranteed by the Government. This applies, as stated above, to every plan that has been so far advanced, and is not peculiar to the one that I am proposing.

If, instead of leaving the title of ownership of the railroads in private hands, the Government should take the title along with the financial responsibilities thereto attached, it seems to me that the problem can be solved with comparative ease through the acquisition, by the Government, of the owners' equity in the properties, namely, through the purchase of the common stock. Under this plan the Government would assume the responsibility for the payment of the principal and interest of outstanding bonds, and the interest on outstanding preferred stock, to the extent that the par value of such securities would be found to be covered by "fair value." Of course, in some cases it might prove advisable for the Government to acquire the preferred stock, but this is a detail.

Under this suggested method of solving one phase of the problem common to all plans, it would only be necessary

for the Government to issue securities of sufficient volume to acquire the owners' equity in excess of the par value of outstanding bonds and preferred stock.

As to the way in which fair value shall be determined, a phase of the problem common to all plans, it seems to me that there are four angles from which to approach the subject: (1) A value based on current market quotations for securities, both bonds and stock; (2) physical valuation; (3) capitalized net income for the "test period," 1915-1917, and (4) investment cost.

It is probable that those in the first instance clothed with the responsibility of determining fair value will be authorized to take into account any or all of these various methods.

It seems to me (a) that the first should have little bearing on the subject, because market quotations not only are subject to manipulation, but, above all, they reflect only the value of the floating supply which usually is a comparatively small proportion of the total issues of outstanding securities; (b) that the second has little, if any, bearing on real value, in the true sense of the word, according to my conception of that term—the desirability of a thing expressed in money, and in any event will take so long finally to determine, that in most instances it will not be available for use when needed; (c) that the third, with proper modifications in special instances, is perhaps the most equitable way of determining fair value, and (d) that the fourth has merit as a check in connection with the main use of the third means of arriving at fair value.

Illustrating how these ideas would work if applied to a concrete case, I will take that of the Norfolk & Western Railroad.

Using round figures, the total income of that company from all sources in 1918 was approximately $20,500,000, from which, deducting interest on bonds and preferred stock and miscellaneous items—say, $5,000,000—there remained about $15,500,000 for the common-stock holders, whose holdings, we will say, are to be acquired by the Government. In capitalizing this annual return, however, there should first be deducted items that cannot be assumed to be of a continuing nature. We will assume that the net annual income to be capitalized is $15,000,000.

Taking into account the risks of the present and future, it would seem that the rate of interest to be used in capitalizing this annual income should be not more than 8%, which would make the value of the common stock, say, $187,500,000.

To compare this with investment cost, $307,000,000, there should be deducted from the latter the par value of outstanding bonds and stock, say, $114,000,000, leaving $193,000,000 as the value of the common stock based on investment cost, this contrasting with $187,500,000 arrived at through capitalization of net earnings for the "test period."

Taking the less sum, the value of the outstanding $120,000,000 of common stock would be at the rate of approximately 156.

As to how the Government would get the money with which to pay cash for the purchase price of this stock, this also may be best illustrated by taking a concrete case.

The owner of 100 shares of Norfolk & Western common stock, valued in the market at the present time at something less than $100 per share, is receiving $700 per annum. On the basis above set forth he would, we will say, be offered by the Government the alternative of receiving $15,600 for his stock (which, of course, includes not only the value flowing from the income he is now receiving, but also future potentialities through the distribution to him of a larger share of the earnings not only of the railroad but also from Pocahontas coal field holdings) or an equal amount of Government 5% bonds returning him $780 per annum.

It is fair to assume that a large proportion of the holders would prefer the ease of mind that accompanies the holding of a Government security and would take the latter instead of demanding cash. Those of a speculative turn of mind would ask for cash, which then, of course, would immediately seek investment in various enterprises, domestic and foreign.

The domestic field being largely restricted because of the removal of the railroads as a field of endeavor, the seeker for high returns would look to other lands in which capital is now so badly needed for restoring the ravages of war.

As a matter of fact, the same will be true if the Government, in effect, guarantees a return on existing railroad securities, including the common stock, as the latter would then be removed from the speculative field, and those of a venturesome disposition would market their holdings exactly as in the case of similarly inclined holders of Government securities issued in exchange for those of private corporations. In other words, the question of raising cash in connection with the solving of the railroad problem, from any angle, appears to be alike whether through guarantee of existing private corporation securities or the issue of Government bonds in payment therefor.

Summed up, it seems to me that the determination of fair value, absolutely necessary regardless of the plan that is adopted, is comparatively easy of solution if gone at in the right spirit by both sides to the controversy; and that the question of financing, also unavoidable no matter which plan is adopted, is comparatively easy in the case of Government acquisition because of the simplicity with which the necessary annual burden will be placed on the shoulders of the users of the railroads, and the probability that a comparatively small proportion of Government securities will have to be sold for cash with which to pay off those stockholders who prefer cash for investment in speculative fields instead of a worryless premier security.

French Tests of Concrete for Ships

DURING the war concrete barges and small ships, mostly tugs, were built by the French Navy. Preliminary to the construction work, experimental investigations were carried on looking into the availability of concrete for shipwork. A few of these are reported in *Le Genie Civil* of Sept. 20, 1919. They include studies into the permeability of concrete against fresh water, salt water, and oils, the effectiveness of certain coatings in promoting oil-tightness, the value of various kinds of rod ends in increasing bond strength, the effect of repetitive loading, and value of reinforcement welding.

It was found that normal concrete could readily be made water-tight both in sea water and fresh water for any pressures that might be expected in shipwork, but the experiments with oil are not as satisfactory as those made in this country. Tests proved the great permeability of light oils through concrete, even when protected with an especially rich mortar face. Of the coatings tried, only one, a French patented process known as the "Holzapfels" method, proved at all efficacious, and the details of this method are not given except to state that it consists of the use of a special paint for oil-carrying concrete. No very good paints were found for the hulls of concrete ships, in which respect the French tests differ from American experience. The rod-end tests showed again that the most effective method is a long, semicircular hook. Further tests of reinforced-concrete bars in kerosene showed that the 72-day immersion in oil materially reduced the bond strength of the steel in the concrete. This concrete is presumably the same kind of concrete as that penetrated by the oil in the previous tests.

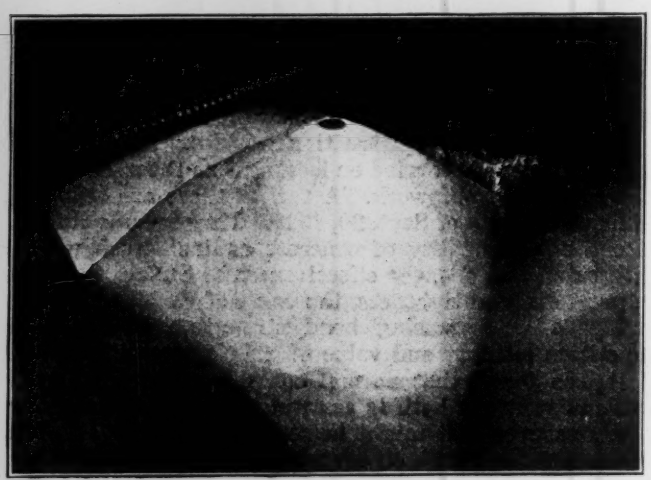
Repetitive tests made on very small pieces, and few in number, indicated that beams are apt to go to pieces under repetitive loading which would not be dangerous as a continuous load. In the conclusions on the welding tests, it is stated that it is possible to obtain a joint fully equal to the strength of the rod itself, but it is thought that ordinary forged welding should not be attempted, as electrical welding and gas-flame welding are much more efficacious and economical. Electrical welding, however, is more expensive.

Toronto Drifting-Sand Filter Results

By Norman J. Howard
Bacteriologist in Charge, Water-Filtration Plant Laboratory, Toronto, Ont.

Abstract of a Paper Read Before the New England Water Works Association

THE drifting-sand water-filtration plant at Toronto, Ont., has a daily capacity of 60,000,000 Imp.gal. in 24 hours, but a maximum rate of 72,000,000 Imp.gal. daily must be maintained for a period of 10 hours. [Under the terms of the contract.—Editor.] The rate of filtration is 150,000,000 Imp.gal. per acre per day. The two principles involved in the operation of the plant are coagulation without sedimentation, and the necessity for a drifting as well as a stationary body of sand in the filter. The coagulant is introduced in the suction well before the water is pumped to the filters. As regards operating results, this paper deals with the year 1918. [The plant was described in detail in *Engineering News* of Dec. 21, 1916, p. 566; a summary of the results of the contract tests was published in *Engineering News-Record* of Oct. 31, 1918, p. 817.—Editor.] When in operation, the stationary body of sand is hard and compact, with a cone-shaped surface. The drifting sand is of a buoyant, spongy nature, and offers little resistance to penetration. In practice it is found that the slope of the drifting surface cone is a minimum of about 32 degrees, and the slope on the surface of the cone forming the stationary plan is about 64 degrees.



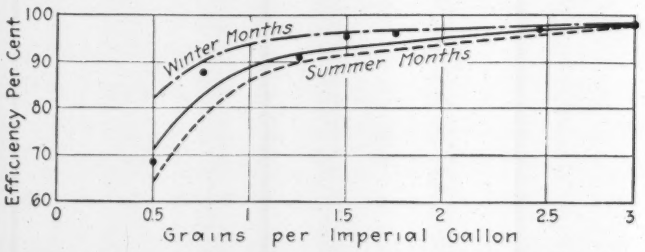
CONE FORMATION IN DRIFTING-SAND FILTER

The initial loss of head in the filters is 6 ft., and it gradually increases to 11 ft., when the filter is backwashed. The length of run ranges between one and seven days, according to the physical condition of the raw water and the amount of alum applied. Backwashing is effected by reversing the flow of filtered water through the bottom of the filter, the wash water coming from an elevated tank having a head of 25 lb. The backwash water is 1 to 2%, and in addition 2% of the water treated is lost through the sand washer.

The cast-iron throats of the sand washers did not wear as long as was expected and they were relined, first with extra-heavy black iron pipe and finally with similar pipe carbonized. Most of the scour has been traced to a tail eddy, which forms at the back of the sand nozzle by the water passing it. By using the modified sand-washer base, scour has been greatly reduced, and a number of new washers are being installed.

During 1918 the only effect of turbidity was to cause an increased amount of alum to be applied for clarification purposes. Water free from pollution offered most difficulty. In the winter months the polluted water required at least 1½ to 2½ grains of alum in order to get a satisfactory effluent. During the summer months it was found necessary to apply at least 2½ grains per Imperial gallon of polluted water which often was free from turbidity. Water slightly polluted required about one grain per gallon.

Frequently, the water becomes heavily polluted after less than 8 hours' change in the meteorological condition. Three abnormal results are excluded from the average of bacterial counts. [That is, the averages are presented both with and without the abnormal results included.—Editor.] One of the results excluded was in September and two in October, when the bacterial



BACTERIAL EFFICIENCIES WITH INCREASE OF ALUM

count in the raw water was in the neighborhood of 15,000 per cubic centimeter, and at the same time an insufficient quantity of coagulant (1.5 grains per gallon) was being applied. On the other occasion the alum was reduced too soon, following a change in the direction of the wind. When chemical tests were made it was found that the water was still polluted, and consequently the alum was again increased. During the intervening period a sample was collected and proved to be unsatisfactory.

Including all bacterial results, the average number of bacteria on standard agar, 37-39° C., was 369.5 per cubic centimeter in the raw and 53.4 in the filtered water, showing an average reduction of 85.4%. Excluding the three abnormal samples, the figures were 303.6, 34.7 per cubic centimeter, and 80.4%. The B. coli were 612 per 100 c.c. in the raw and 31.7 in the filtered water, with a total average reduction of 94.8%. Excluding the three abnormal samples, the corresponding figures were 608 per cubic centimeter for the raw water and 22 for the filtered water, with an average reduction of 96.4%. The chlorinated water showed an average bacterial count of 1.72 per cubic centimeter, while only two samples out of 1900 showed the presence of B. coli in 1 c.c. This gives a total removal of 99.9 per cent.

The original specification called for certain efficiencies being obtained on an average of one grain of alum per Imperial gallon, this figure being largely based upon the results from an experimental plant on Humber Bay water in Toronto. As a result of practical experience with the mechanical filtration of Lake Ontario water, considerable modification has had to be made as regards the operation of the new plant. Conclusive evidence shows that Lake Ontario water cannot be bacterially purified to a high degree by mechanical filtration with only one grain of alum per Imperial gallon. The actual purification effected by the drifting-sand filters in 1918 was on an average application of 1.027 grains of alum per Imperial gallon, and the results obtained with so small an amount are satisfactory. The accompanying diagram shows that if a higher dose of alum be applied a corresponding degree of purification is obtained. The economical practice, however, had to be taken into con-

sideration on account of the enormous cost of aluminum sulphate, and when it is considered that during periods of high pollution as much as 2.5 grains per gallon was applied, a policy of operation that was definitely economical as well as practical had to be adopted. The final conclusion is that the drifting-sand filters during 1918 effected satisfactory purification with an average of one grain per alum per gallon.

New Life Apparent in Engineering Institute of Canada

Inclusion of All Engineers in Society, and Certain Constitutional Changes, Invest Members With Sense of Individual Responsibility

REVIVIFICATION of the Engineering Institute of Canada, accomplished through certain constitutional changes which have been operative a sufficient length of time to permit judgment of their merits, is attested in recent correspondence to *Engineering News-Record* from the institute's secretary, Fraser S. Keith, and is reflected in recent copies of the institute's *Journal*. Broadening the scope of the organization by changing the name of the Canadian Society of Civil Engineers, which included but a part of Canada's technical men, to the Engineering Institute of Canada, in which all classes of technical engineers are admitted to membership, and the investment of each member of the institute with a feeling of direct responsibility to the public, as well as to the technical organization of which he is a member, are conditions that Mr. Keith holds accountable for the increase of the institute's usefulness and the enlargement of its influence.

As another contributing factor to the reinvigoration of the institute, Mr. Keith points to the new system of election of counselors, of whom there are 38, consisting of a president, 3 past-presidents, 4 vice-presidents (2 elected each year), and 30 counselors—10 elected each year. The sphere of influence of the institute is more or less geographically divided into 16 districts, each now supporting strong local organizations, and counselors are representatives of the districts in which they are elected instead of being elected from the membership at large, as was the case under the old system.

District chapters of the institute have become very strong, and the system now in vogue of holding provincial, interprovincial or regional, and Dominion sessions has resulted in the establishment of a strong national organization. Formerly all meetings of the society, including the annual meeting, were held in Montreal. Now the annual meeting may or may not be held at Montreal, and any meeting of any branch is as important and as influential in proportion to the number of its membership as any held at Montreal or elsewhere, with the exception of the annual meeting and another form of meeting which is an elaboration of a system formerly in vogue. In discussing this latter method of bringing institute members into close personal contact, Mr. Keith offers the following explanation:

Professional Meetings Stimulate Interest

"These are called general professional meetings, and were adopted to give the members in the various parts of the country an opportunity not only to attend a meeting of the whole institute, but to bring members in various provinces together and to make them better acquainted; to permit discussion of local engineering problems; and to allow members larger participation than theretofore in the affairs of the whole institute. Discussions at these professional meetings are not limited to local engineering problems, but may, and often do, include those affecting the whole profession. Although the by-laws permit one general professional meeting to be held annually in each province, it was found that this procedure was neither desirable nor expedient. Now at least one professional meeting each year is held in the East and one in the West—these professional gatherings are in addition to the general professional meetings usually held in connection with the annual general session of the institute."

These general professional meetings, Mr. Keith states, have been of greatest benefit not only to the individuals attending them but also to the technical profession concerned in the discussions. "Much greater stimulation of professional spirit than any that theretofore existed has followed such meetings," says Mr. Keith, "and members residing at great distances from headquarters have been impressed, because of their participation in such conferences, with a sense of direct responsibility to both the public and to the institute."

Questions in which all members of the institute are professionally interested are discussed in the *Journal* of the institute, a monthly publication whose single purpose, as the cover on each issue proclaims, is: "To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interest, to encourage original research, to develop and maintain high standards in the engineering profession, and to enhance the usefulness of the profession to the public."

Is Medium for Professional Discussion

Two of the most vital of the problems confronting engineers—those bearing upon professional legislation and salaries—have received the widest discussion in the *Journal*. The most far-reaching in its possible effects of all legislation proposed by the institute has been a recently drafted bill providing for the examination and registration of all professional engineers practicing in Canada. This bill was drafted by a special committee of the institute, one member being chosen from each of 16 districts. The proposed bill defined a professional engineer, declared who might practice, provided for regulations governing engineering partnership, and included provisions for the suspension of members because of misconduct, with penalties therefor, and set forth those rules governing the examination and the registration, both with and without examination, of professional engineers.

The strength of district organizations is indicated in the manner in which they have attacked the question of obtaining salary increases for Canadian engineers, particularly those in civil-service employ. Letters from various chapters of the institute, urging upon members of Parliament the necessity for making adequate financial provision for those engaged in engineering work, as well as personal letters from members of the institute to members of Parliament secured from members of Parliament, in many instances, pledges to support legislation favoring increases in engineers' salaries.

Not only has the institute been particularly concerned with questions of legislation and compensation, but its district branches have often led in industrial developments in their respective localities. A good example of such work comes from the Victoria branch, which has charged itself with the organization of a committee bearing the tentative designation of the "British Columbia Board of Industry." This board, including returned soldiers, representatives of various

financial and manufacturing interests, boards of trade, and like organizations, is to investigate possibilities and develop propositions for the general industrial development of the province.

Further proof of the public-spiritedness of members of the institute is evident in the example set by members of the Winnipeg branch. During a strike in that city, when power-plant operators and men responsible for the supply of water to the city joined in the strike, members of the Winnipeg branch took off their coats and kept the plant in operation.

A great deal has been done by the institute itself as well as the district branches toward re-establishing returned soldiers in civil occupations. Committees from these district branches, co-operating with the Department of Soldiers' Civil Re-establishment, are representative of both employer and employee, and such committees have been frequently instrumental in placing in congenial positions returned soldiers who, before entering the service, had followed engineering work in Canada.

New branches of the institute may be organized only upon the request of a sufficient number of members in any locality. Consent of the council must be obtained before any new branch is inaugurated. Already a number of new branches have been started.

Schoharie Development Involves Dam and 18-Mile Tunnel

By J. Waldo Smith

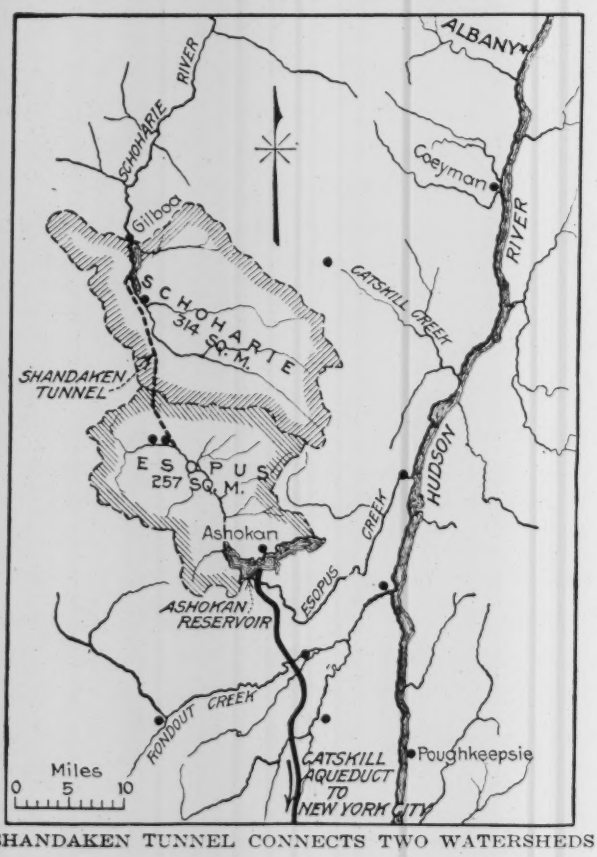
Chief Engineer, Board of Water Supply, City of New York

Abstract of Paper Read Before the New England Water Works Association

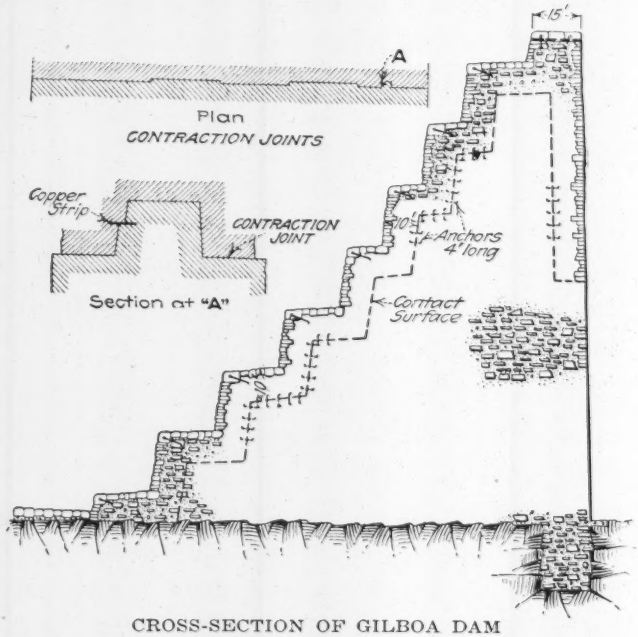
AN 18-MILE tunnel in rock and a dam 160 ft. high with both masonry and earth sections, involving a combined cost of $22,000,000, are the main features of the development of the Schoharie watershed which the Board of Water Supply of New York City has undertaken as part of the original Catskill project for an additional daily supply of not less than 500,000,000 gallons.

Of this total amount one-half comes from the existing development of the Esopus watershed, while the Schoharie works, now under construction, will be depended upon for the remainder. As shown in the accompanying drawing, the Schoharie water will be collected behind the Gilboa dam, forming a diversion reservoir of 20,000,000,000-gal. capacity, from which the flow will be through the 18-mile Shandaken tunnel to a point of discharge into Esopus Creek, and thence along the original stream bed into the Ashokan reservoir, the main feeder of the Catskill aqueduct.

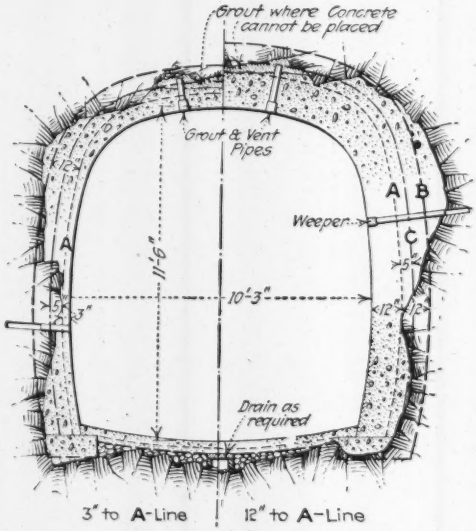
The Gilboa dam will be of two distinct types. The overfall, or masonry, section, 1300 ft. long, is designed with steps on the downstream side leading to a spillway channel along the toe of the dam. The earth portion of the dam is of conventional design with masonry core wall and heavy rock paving on the upstream slope; its length is about 1000 ft. At the transition section the dam will be flanked both upstream and downstream by



SHANDAKEN TUNNEL CONNECTS TWO WATERSHEDS



CROSS-SECTION OF GILBOA DAM



TYPICAL TUNNEL SECTIONS

a heavy masonry retaining wall to intercept the long slope of the earth section. Dovetailed contraction joints with a continuous vertical copper strip water-stop extend across the dam from the foundation upward at intervals of 80 feet.

A cross-section of the Shandaken tunnel is shown in an accompanying drawing. The tunnel will have a maximum capacity of 600,000,000 gal. a day and will be operated intermittently at varying rates, depending upon the condition of stream flow and storage. Its construction will require about 5.7 cu.yd. of excavation per linear foot of tunnel. There are, in all, seven intermediate shafts, concrete-lined, and having a 14-ft. diameter. The aggregate depth of shafts is 3238 ft., while the maximum depth of a single shaft is 630 ft. The minimum distance between shafts is 1.3 miles and the maximum 2.7 miles. At the present writing the shaft-sinking work has been practically completed.

Proposes Government Testing of All Cement

Extract from testimony of Dr. S. W. Stratton, Director of the Bureau of Standards, before subcommittee of House Committee on Appropriations in charge of deficiency appropriations.

MR. STRATTON—During the war we had to establish three or four [cement testing] stations—one at San Diego, one at San Francisco and one at Denver—all for Government work. Four or five men were kept at each. It was cheaper to do it there than to ship it to other places. Of course, this is all done for the departments. There is no reason why the states should not have the right to use out of Government-tested bins of cement, and they should do so.

MR. BYRNS—Have the state [highway] commissioners availed themselves to any extent of the services rendered by the bureau?

MR. STRATTON—Not of the inspection service. They come to us for help in standards and we help them all we can. There is no reason why the state commissioners, and even the public, should not be permitted to buy from inspected bins. . . . I wish that this service might be extended to the United States and also to the public. I do not see why the public should not have the benefit of the guaranty. It would cost but very little as compared with its importance, and would, I think, meet with the approval of manufacturers of cement, who desire, as a rule, that their product should be good.

MR. BYRNS—You say you wish it might be extended. Just what do you mean by that?

MR. STRATTON—I mean that with $60,000 out of the item for structural material to do that work we can only do a small part of the work required for the Government service here. With a larger appropriation we could test cement at the great centers of manufacture—and there are not many of them—and let the people buy their material from these inspected bins. This estimate we are considering does not contemplate that, but it should be done in time, and would not cost much additional.

MR. BYRNS—Then it is a question of funds?

MR. STRATTON—Yes, sir; absolutely. Our organic act would, I think, cover the authority. These increased funds do not anticipate that work for the public, but simply for the increased Government construction.

Sewage-Treatment Report Forms and Testing Apparatus

Monthly Blank Sheet for Daily Test Records and Apparatus for Finding Settleable Solids and Sludge Depths

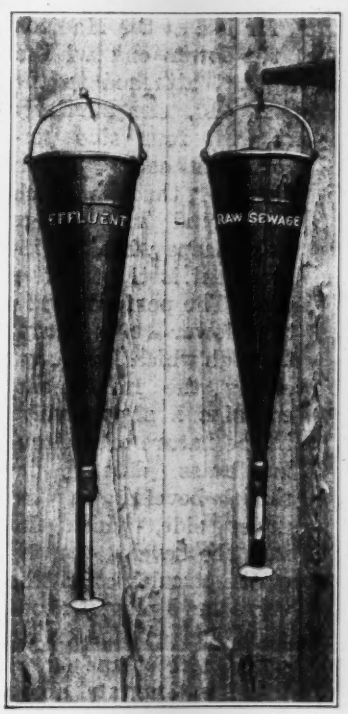
BY E. J. TULLY
Chemist, State Board of Health

AND JAMES H. MACKIN
Operating Engineer, Madison Sewage Works

A REGRETTABLE feature of the sewage-treatment plants which have been inspected by the sanitary engineering division of the Wisconsin State Board of Health has been the lack of operation data. This is due, at least to a considerable degree, to what seem to the operators as difficulties in making the simple and necessary tests required for practical purposes, and in part to lack of recognition of the value of treatment data.

With a view to securing enough data to show general plant accomplishment, at least in connection with the larger units, the division has initiated a program of instructing sewage-works operators in regard to the general functions of sewage-treatment units, and as a part of this plan has prepared a monthly report sheet for settleable solids and stability. Some simple testing apparatus has also been devised.

The gravimetric method of determining suspended solids is not suited to the average plant, because of lack of proper facilities. Realizing this, attention was directed to developing a method of determining settleable solids, combining simplicity, approximate accuracy for operating purposes, and utility in the hands of the ordinary operator. With these features in mind, a volumetric instrument was devised, consisting of a 100-c.c. graduate with unit divisions, and without a lip, attached at its upper end by a rubber collar to a 1-gal. funnel having its sides sloped at 80° and finished smooth inside and without a shoulder at the point of junction of the angular sides with the narrow part of the funnel.



FOR DETERMINING SETTLEABLE SEWAGE SOLIDS

The utility of this simple instrument for practical purposes is illustrated by its service over a period of nine months at the large treatment plant at Madison, under the supervision of one of the writers, who had six of these instruments made and placed in use. This plant includes a sedimentation unit comprising primary, secondary and colloidal sections, each section divided into five chambers; a contact dosing section of five chambers; and a three-section percolating filtration unit of 2.3 acres surrounded by a

moat or shallow sedimentation chamber. An average of 4,000,000 gal. is treated daily. The procedure at this plant in determining the general effectiveness of sedimentation includes collecting twice each morning and afternoon samples of raw sewage and effluents from the chambers in service, and reading the sediment after a period of two hours, the instruments being placed in a rack for convenience. The readings are recorded and averaged on the report sheet. Filtration accomplishment is determined by the methylene blue tests. Samples are daily collected from each section of the filter as discharge takes place into the moat, and a combined effluent sample is also taken. The putrescibility tests are run for 10 days at 20°, and the results are recorded on the report sheet, a copy of which is submitted to the division each month.

MADISON SEWAGE TREATMENT SYSTEM

Monthly Summary of Operation and Results

RELATIVE STABILITY TESTS AND REMOVAL OF SUSPENDED MATTER Month of_____

Date	Millions of Gallons Treated	Contact Aeration Filters Comb. Effl.	Trickling Filters: North Sec. Effluent	Trickling Filters: West Sec. Effluent	Trickling Filters: South Sec. Effluent	Combined Final Effluent	Outfall Sewer Tubers River	Lake Monona	Raw Sew. A. M.	Raw Sew. P. M.	Sediment Unit No. 1 A. M.	Sediment Unit No. 1 P. M.	Sediment Unit No. 1 % Removed	Sed A. M.	Unit No. 5 M.	Unit No. 5 % Removed	Plant % Removal A. M.	Plant % Removal P. M.	REMARKS
1																			
2																			
3																			
31																			

APPROVED_____ State Sanitary Engineer

_____SUPERINTENDENT

FORM USED FOR RECORDING RESULTS OF SEWAGE TREATMENT AT MADISON, WIS.

The original was 18 by 10 inches. At the left there is a margin of two inches, with holes for loose-leaf file, and at the right there is a three-inch margin for remarks.

The instrument suggested for ascertaining the approximate depth of deposits has been developed in detail by Mr. Mackin. It consists of a thick-walled glass tube, of 25 in. internal diameter and, for use at the Madison plant, 5 ft. long, equipped at the lower end with a perforated brass cap, fitting tightly, attached to the glass by litharge. At the upper end, and similarly attached, is another brass cap with four side perforations, each ½ in. in diameter, through which the liquid and sludge may escape when the instrument is tipped after use. The perforation in the lower brass cap, through which the sludge enters the instrument, contains a simple valve in the nature of a circular brass plate, ⅛ in. thick, beveled on the under side, which fits into the beveled opening of the circular cap. The valve has a play of about 1 in. and carries on its lower side three short legs 1 in. long and about ⅛ in. thick, bent in such a way as to give the 1-in. play mentioned. When the instrument is lowered into the deposit the valve is pushed upward and sludge enters. The valve is pulled into place by the hydraulic pressure when the apparatus is withdrawn from the tank. The instrument may be provided with a long wire handle—the weight of the instrument is sufficient to carry it to the bottom of the tank—or attached to a pole. This simple device has proved useful for the purpose of ascertaining the approximate depth of deposits and in indicating when cleaning of this type of units should be undertaken.

APPARATUS FOR FINDING SEWAGE SLUDGE DEPTHS

All percolating filter effluents, combined and as taken from the sections, have shown over this period an indicated relative stability of 95%, with the exception of 12 samples taken at section outlets when "unloading" was occurring during extremely hot weather, and at these periods the relative stability was not less than 50%. In no instance, however, was the relative stability of the combined effluent less than 95%. The removal of settleable solids by the sedimentation unit, as determined volumetrically by the instrument, averages about 90%. The device readily serves to indicate when a section needs cleaning, as the settleable solids substantially increase under such conditions.

Watershed Leakage in Relation to Gravity Water-Supplies

By Robert E. Horton
Consulting Hydraulic Engineer, Voorheesville, N. Y.

Abstract of a Paper Read Before the New England Water Works Association

PROBABLY everyone has noticed the apparent difference in yield sometimes occurring in the case of small adjacent similar drainage areas. When precipitation, soil and cultural conditions for such areas are similar, the difference in yield is no doubt due to watershed leakage.

Watershed leakage may be defined as the passing of water under ground from one topographic drainage basin into another. The area tributary to a stream at any point may be considered as a drainage basin at that point. Watershed leakage often occurs from the upper to the lower portion of the same drainage basin; that is to say, some of the waters naturally tributary to the stream above a certain point do not enter the stream above the point but pass under the ground into the stream at some lower location.

Watershed leakage may also be defined as a condition where the boundary of the groundwater horizon supplying the stream is not coincident with the surficial watershed line. Nearly all large artesian systems involve watershed leakage, but this discussion will be mainly limited to its occurrence in conjunction with the surficial groundwater horizon.

Watershed leakage from the upper to the lower portion of the same drainage basin, or from the lower portion of a tributary to the stream it enters, is commonly called "underflow" in the West. Its occurrence requires that the groundwater horizon shall lie below the level of the stream bed. In such cases water may be lost from a stream directly by percolation from the stream bed, or there may be no such loss, and the bed of the stream frequently becomes water-tight or impervious

as a result of the clogging of the pores in the streambed material. A stream channel of this character has been described by O. E. Meinzer as an "insulated stream."

Many gravity water-supplies, and some high-head power developments and irrigation systems, are dependent on the yield of relatively small drainage basins, which often lie at high elevations. Rainfall records of such basins, and gagings of the yields of such small areas, are much less common than in the case of large drainage basins, and in estimating the available yield it is frequently necessary to depend upon studies based on rainfall and water losses, gagings of other streams, or these data in conjunction with limited gagings for the stream in question.

When any small drainage basin is proposed as a source of upland or gravity water-supply, or for similar uses, where watershed leakage is liable to occur, the yield should be determined by gagings, if possible. In the absence of a long gaging record, measurements during a dry period, in conjunction with observations of rainfall, are very desirable. If the occurrence of watershed leakage is suspected, the drainage basin should be examined with reference thereto.

[After giving a number of examples of watershed leakage due to various causes, the author concluded his paper as follows—EDITOR.]:

In investigating watershed leakage, especially in small drainage basins such as are used for gravity water-supplies, the following suggestions may be useful:

1. Watershed leakage is always from a higher to a lower drainage basin. In case of inversion, higher-lying adjoining areas should be examined. In case of diversion, the presence of lower-lying adjoining areas which may afford an outlet for the water losses should be looked for.

2. Aside from loss through solution channels in limestone regions, watershed leakage usually occurs only where there is a continuous groundwater horizon. It does not occur where there is an impervious rock barrier forming the boundary between the two areas in question.

3. Watershed leakage is more likely to occur in areas overlain by deep beds of sand, gravel or porous glacial deposits between areas with less permeable soils, or with rock near the surface. It is more likely to occur in regions underlain by limestone and sandstone than in regions underlain by shale or granite. It is more likely to occur through rock of moderate dip than through horizontal strata, and it is more likely to occur through broken, seamed and fissured rock than through compact, uniform beds of rock.

4. It is more likely to occur between basins with low, poorly marked watershed divides than between steeper areas. The configuration of the surficial groundwater tables generally follows closely that of the overlying topography, and the topographic form, as well as the geologic conditions, should be taken into account.

Summarizing, the shallower the soil mantle, and the closer to the surface of the rock, the steeper the slope, and the more impervious the soil and rock, the less the likelihood of serious watershed leakage.

Railway Bridge Painting Practice

RED lead as the priming coat and lampblack or graphite for the succeeding coats represents the prevailing practice in painting railway bridges, according to a committee report presented at the recent annual meeting of the American Railway Bridge and Building Association.

Of 17 railways, 13 favor red lead in some form for the primer, and the report states that although there are a number of inhibitive pigments on the market none of them has the same popularity as red lead. One of these roads favors a mixture of 33% white lead and 67% red lead, while another adds 1% of lampblack to make the paint denser and more impervious to moisture. The other four roads use a proprietary paint for the primer. For the succeeding coats, opinion is divided about equally between lampblack and graphite, while two roads report satisfactory results with mineral brown. The method which seems to be most generally used and to give the best satisfaction is to prime the work with red lead, using a mixture of red lead and lampblack for the second coat and lampblack and graphite for finishing.

By mixing lampblack with the second coat the difference in color makes it easy to see that the work is properly covered, while the finer pigment increases the density of the paint.

Temperature does not appear to have much influence on the life of paint, the durability of similar paints being identical in the mountains of Montana and the hot valleys of Arizona, although there is a temperature difference of 50° to 60° most of the time. The shortest life is reported from coast regions where the atmosphere is damp, warm and impregnated with salt. Under such conditions painting must be done every year. The longest life is reported from Montana and Texas, where repainting may be required only at intervals of 15 to 18 years.

For experimental purposes, one span of a bridge in Idaho was finished with a bituminous paint and the other with a standard bridge paint composed of 10% red lead, 50% lampblack and 40% inert material. After 10 years the latter was in excellent condition but the bituminous paint had disappeared, except for a layer of black dust which was removed easily with a scraper and duster. As the red-lead priming coat had been well applied there was no rusting.

Bridge paint is used with success for water tanks and coaling stations, but some tanks are painted on the inside with hot tar. An extra coat of paint may be applied to prevent rust at the footings of tanks due to the spilling of water from engines. Paint does not adhere well to galvanized iron, unless the zinc is partly removed. The best plan seems to be to leave this material unpainted until the zinc coat has been lost by exposure, thus obtaining its full value before incurring the expense of paint.

Decline of Typhoid Fever in New York City

Typhoid fever in New York City has declined from 21 deaths per 100,000 in 1898, the year of consolidation, to 3.3 in 1918, according to a review by Dr. Louis I. Harris, in the *Monthly Bulletin* of the Department of Health, New York City, for August, 1919.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Professional Obligations of the Engineer

Sir—The professional engineer should no more adopt union tactics in solving his problems than the physician; although his duty to society is not so evident, and although a suspension of it would not have effects directly so severe as the suspension of the duties of the physician. The eventual results would be as bad, however, and a universal suspension of professional functions would constitute a breach of faith with the public, which has learned to depend upon the engineer.

It is as unthinkable that a group of engineers should strike as that a group of ministers should forsake the pulpit in a body. Yet no one would blame ministers as a group from doing, in an effort to increase their remuneration to an adequate figure, anything that did not interrupt or affect their service to mankind.

The engineer asserts that he renders a higher service to humanity than the functions of a trade or a business. This higher service imposes on the profession an obligation of continued service which transcends any matter of compensation. This obligation limits the possibilities of collective bargaining to reasonable statements, scientific studies and reports, firm requests and coöperation.

It cannot be denied that unionism, in some circumstances, may be not objectionable, but, carried to the extent when the strike is its principal weapon and when its leaders hobnob with socialism and bolshevism, unionism makes a sticky mess which will soil the hands of any professional man who attempts to associate himself with it.

There is no use wasting words arguing for the principle of unionism. Unionism is what it is, not what it might be. The engineer who joins a union may still be an engineer, but he is no longer a member of the engineering profession—not because he has by joining admitted the principle of collective bargaining, but because he has aligned himself with an organization which places selfishness above service and resorts to the strike as a means of enforcing its demands—even in the face of the public welfare. There is no halfway landing. An engineer is either a professional engineer or a union man—he can't be both. SIMULTANEOUS.

Chicago, Ill.

[The above communication was sent to *Engineering News-Record* as the result of asking several engineers to dictate offhand their views on trade unionism within the profession.—EDITOR.]

Labor Conditions "Then and Now"

Sir—I read with a great deal of surprise and regret an article on the front page of the "Emergency Bulletin" of Oct. 30, 1919, entitled "Then and Now."

I consider the entire article a gratuitous insult to American citizens of Irish ancestry.

I take it that readers of *Engineering News-Record* are interested in engineering problems and their relation to the economic situation generally.

An editorial on existing labor and industrial conditions comes, of course, within this scope, but I submit that the domestic-servant problem of 1869, as judged by the Secretary of the Navy in office then—even assuming his judgment to be sound, which is not admitted—or, for that matter, the domestic-servant problem of 1919, should not be used as a criterion of engineering or industrial conditions today.

I hope it is only a coincidence that the quotation from the Secretary of the Navy of 1869, reflecting, as it does, upon the Irish people, appears simultaneously with similar gross misrepresentations recently made over the signature of a prominent admiral of the United States Navy. JOHN E. L. MONAGHAN,

District Engineer, Boston Sewer Service.

Boston, Mass.

[A reading of the note in question indicates, to us at least, that Mr. Welles was discussing the labor problem generally, and that his reference to "domestic labor" served as an example. How else account for his comment on demagogue politicians and the pernicious influence of the *New York Tribune?*—EDITOR.]

"What Causes This Water-Hammer?

Sir—My attention has been called to a communication entitled "What Causes This Water Hammer?" which appeared in *Engineering News-Record* of Sept. 11, 1919, p. 530, and was signed by B. Gibson, in which the writer desires information concerning the cause of water-hammer in an isolated water-works system. In this case the water is lifted to an elevation of 90 ft. by a double-acting piston power pump and delivered into an open tank. The pump is provided, as he states, with an air chamber or cushion.

The writer did not give the size of the pipe through which this volume of water is delivered; perhaps the pipe is not sufficiently large to deliver the water without much friction head. That can be best ascertained by observing the pressure gage on the water line near the pump. If the pressure remains relatively the same whether the pump is operating or whether it is not running, then the friction is not excessive, but if the pressure at the pump exceeds 45 lb. when pumping against the 90-ft. head, a larger pipe should be supplied, unless there is some way to slow down the speed of the pump. The pump is now running too fast, as the piston speed should not exceed 200 ft. per minute.

I might say also that many "air chambers" are not air chambers at all, being filled with water through a leak or otherwise. This fault can be remedied by allowing the water to run back through the check valve or a bypass. All plumbing, if properly done, provides for air cushions, but to keep them filled with air requires constant draining out of the water after the outside valve is shut. W. P. BULLOCK.

Kansas City, Mo.

Thirty-five-Minute Angle Method of Traversing

Sir—In *Engineering News-Record* of August 21, 1919, p. 373, there is an article on "Traversing by a Thirty-five-Minute Angle Method," by John H. Sawkins, and in the issue of Sept. 18, 1919, is a letter commenting on the same by R. F. Jaeger. A reference to an article, in *Engineering News* of Nov. 5, 1914, p. 943, will show the method described by the writer, with the exception that 0°34′ is recommended instead of 0°35′. The sine or tangent of 34′, or 2 × sine of

17′ (considering the measured distance as a chord) is more nearly $\frac{1}{100}$ than the sine or tangent of 35′ or 2 × sine of 17½′. For ordinary distances it is still more accurate to use a horizontal angle of 1° 09′, and divide the "spread" by 2 before multiplying it by 100.

I agree with Mr. Sawkins that for rough traverses, with long sides, this method is quite convenient and useful, and has the following advantages in comparison with the stadia: "It permits the use of the plain transit reading to minutes with the ordinary cross-wires, requires no stadia or level rod, no reduction to the horizontal, and longer courses can be taken than by the stadia or gradienter method. The transitman is not limited by the distance at which he can distinguish figures on a rod, but by the distance at which he can clearly see a sight rod."

Mr. Jaeger objects to the probable errors due to the difficulty involved in approximating a right angle. At a distance of 500 ft. an error of about 5° in this approximation would cause an error of only 0.02 ft. in the measurement of the spread, and 10° would cause an error of but 0.08 ft. in measurement. It is not necessary to carry two flagpoles, as the writer has frequently used the following procedure: The flagman carries an ordinary chaining pin, and after giving sight at the first point sticks the pin into the ground through the ring at the end of the metallic tape, and then gives sight at the second point, at the same time reading the tape.

Mr. Jaeger describes how he determined a distance by measuring the angle intercepted by a 20-ft. rod on a distant hill and multiplying the cotangent of this angle by 20. This method is manifestly incorrect unless correction were made for the vertical angle.

That for general topographic surveying the stadia used in connection with the transit or plane-table is the best method is admitted. Its accuracy depends largely upon the care taken in determining the constants, with proper use of reduction tables or slide rules, and on the skill of the transitman and his assistants. In the case of offices, such as railway maintenance or construction, where the instrument-men are often unfamiliar with the theory or practice of the stadia, the "34′ method" may be used to advantage in rough traverses where an accuracy greater than about 1 in 200 is not required. It has been used for years by railway engineers in the West in determining drainage areas in the case of water-way or bridge surveys. The successful surveyor gages his methods according to the purposes of his survey. G. F. SCHLESINGER.

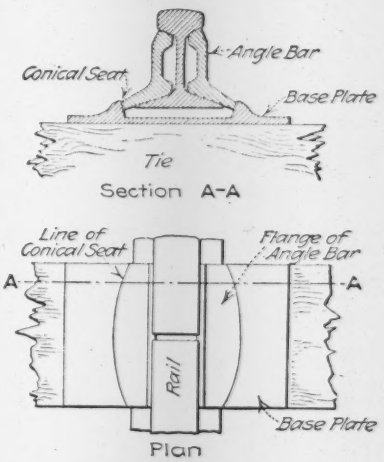
Columbus, Ohio.

Rail Joint Simulates Continuous Rail

Sir—To eliminate the hammering due to wheel drop at joints in railroad track, a homogeneous rail juncture should probably be developed, for the reason that kinetic conditions at the juncture influence a cupped wear on the receiving end of a rail. It is significant that cupping is audibly announced before there is perceptible trace of wear and before relative motion of rail ends has set in. A proposed design for such a joint was illustrated in *Engineering News-Record* of June 26, 1919, p. 1278, showing two of the three essential elements. Now it is proposed to include the third element which completes a homogeneous rail juncture.

It was previously implied that the metal in contact with the rail ends should be reduced to a minimum and that the posture of a rail across a tie should be simulated by introducing a common support for the rail heads through the juncture, while the rail bases are held out of bearing contact. Then a continuously effective pressure should be provided in lieu of bolt pressure.

It will be observed from the accompanying drawing that the length of the angle bars is limited by the requirements for two bolts to hold the rail ends against longitudinal separation, and also that the angle bars support the rail heads while the rail bases are held out of bearing contact by seating the angle bars on a base plate resting on a tie. The base plate has conically shaped seats that engage the similarly shaped toes of the angle bars. This engagement is operated by the wheel load, which permanently sets the conical tightening elements, providing continuously effective pressure to complete a homogeneous rail juncture, which is virtually a weld in the open track, built up synthetically.



PROPOSED RAIL JOINT EQUIVALENT TO CONTINUOUS RAIL

My claims for these conical tightening elements were allowed by the United States Patent Office, Oct. 4, 1919.

Newburg, N. Y. W. M. PEGRAM.

On the Economy of Motor Trucks and Good Roads

Sir—I have been greatly interested in the article in your issue of July 10 on the sphere within which, on a strictly economic basis, the use of the motor truck is justifiable. Your study of the problem, which study is, in my opinion, in the main, sound and pretty thoroughgoing, shows in brief that a light railway is a cheaper means of moving freight when there is as much as 25,000 tons annually than a motor truck, for a length of haul of 10 miles.

But what influence does this conclusion have on the action taken by state highway commissions and on good-roads propaganda put forth by automobile salesmen? Why, the influence is practically *nil*. Yet such an investigation as you made *has* value. We go into the matter of wasting millions with our eyes open, at any rate. When you say that the only correct basis of comparison as between railroads and trucks is to charge the motor truck with the cost of building and maintaining the road, you are making a beautiful display of charming *naïveté* that is, except for its "charm," about as effective as spitting at the moon. Surely that is the only correct basis, but when the jobs of 10,000 men depend on that fact being suppressed, as much as it can be suppressed, and when the sales of motor factories capitalized at many millions of dollars depends on that conclusion being hid, what chance is there that the truth will make its way and will be heard from?

In the very same issue of your paper is a letter from

Prof. C. T. Johnston of Ann Arbor, Mich., touching on "common surveying" and on unionism among young engineers; such unionism is logical when the leaders in the profession will not make a stand for sound economics. And when the leading members of the profession will not trouble themselves to point out even *some* of the extravagance of the propaganda working day after day for highway "improvement" and some of the bias that exists on the part of salesmen of the automobile industry, when they cry "good roads," the advancement of the engineering profession will not go forward as it should.

The fact that the rate of interest on capital has risen to so great a height shows clearly and unmistakably that capital has become scarce and should be conserved in every way possible—in other words, saved.

The "good-roads" movement is without doubt intimately connected with the automobile production movement, though one is under Governmental and the other private control. In my city (Nashville) the construction of garages goes furiousiy forward, though rents for dwelling houses are very high and, even so, houses are scarce and hard to get. And as everybody knows who has watched the course of the stock market in New York, the leading automobile stock, General Motors, has led the way in the recent boom in stocks and frenzy of speculation. As engineers we are not, perhaps, concerned with the stock market and with speculation and with money rates, etc., but in another sense there is nothing affects us so vitally. If capital goes into building motor cars and good roads to excess, then there is less to be had for building railroads and houses and the thousand and one other things which are vitally necessary and which some of us have spent a lifetime learning to build (railroads, for example). When our employment stops, pretty nearly everything stops with us for the time being, and so far as the public is concerned, if a wrong course is taken in building, let us say, garages instead of cotton-spinning mills, then surely we are impoverishing ourselves and are sure to feel the effects later—though not in the very distant future, either.

I am not pessimistic. I think we shall have progress; but in some ways, as I believe, it will come more quickly than in other ways, and I believe that a rational program will get us farther than an irrational one. I was struck by an editorial in *Engineering News-Record* of Oct. 2, which said that nine-tenths of our engineering knowledge was originally empirical and based on precedents, or words to that effect—the idea being that our engineering science has slowly evolved and really reaches back for thousands of years (in some cases). That being so, we should argue that if rail transportation has given economical results in the past fifty years we should not lightly divert all our capital from railroads and well tried operations to automobiles (or even, if you will, to motor trucks and "good roads").

JOHN WILKES,
Civil Engineer.

Nashville, Tenn.

[There is little doubt that we are in serious danger of the overstimulation of highway development. But the propaganda that has brought the rapid popularity of good roads about is not entirely printer's ink propaganda. The best promoters of good roads have been good roads themselves and the automobiles and motor trucks that are rapidly becoming standard equipment on every farm. But Mr. Wilkes is right in insisting on a better understanding of transportation economics. Only by such understanding shall we work out at lowest cost our transportation problems.—EDITOR.]

More Accuracy Needed in Collecting Data on Rainfall

Sir—I inclose a photograph of the rain gage and thermometer station at Bakersfield, Calif. The records from this station are published by the Weather Bureau month after month and, I presume, year after year. It will be noted that the drooping trees which are above the rain gage will make particularly erratic any record obtained therefrom. The picture is of more interest because of the moral that it carries than because of the inaccuracy of the station. I have seen other stations that have been made fully as inaccurate by local change as this one, notably the building of a brick wall next to a rain gage at one of the oldest stations in southern California, at Escondido.

RAIN GAGE IMPROPERLY LOCATED BENEATH TREES

The point this illustrates is that the Weather Bureau does not inspect its field stations. The excuse is that Congress does not appropriate the money to make the inspection, but probably the reason for its not doing so is because it is not asked with sufficient vigor and explanation.

Engineers who are studying the physical data of a region use records of this kind, and are misled. It seems to me improper that the Government should continue an official publication of a record without knowing something of its accuracy. To me the whole system of meteorological observations by the Weather Bureau needs a complete and most thorough renovation. The main or official stations are nearly always located on the roofs of tall office buildings and are placed in cities of the larger size rather than in such places as will best illustrate the physical data of the region in question.

For instance, in California the official stations are either in the low valleys or along the seacoast, and there are no regular stations in the high mountain regions from which the water-supply of the state comes and where the climatic conditions are totally and radically dissimilar from the points of official observation. The rainfall records that are taken on the roofs of tall buildings are not correct representation of the rainfall that occurs on the ground, because of the effect of eddying winds on the gage; neither are temperature records taken on tall buildings a correct index of ground temperatures.

In a horticultural region such as southern California, where a few degrees make the difference between the freezing or nonfreezing of a citrous crop, such discrepancies are material and misleading. If the Weather Bureau desires to maintain its records in comfortable office buildings, it should at least have substations on

the ground which would establish the factors of error in the main stations.

This question was made the subject of a special report of a committee appointed by the American Society of Civil Engineers for the Los Angeles section several years ago; the report was published by the parent society. Apparently the Weather Bureau has gotten into the habit of doing business in a certain fixed way, and it will require a scientific earthquake to produce some change in habit. J. B. LIPPINCOTT,

Los Angeles, Calif. Consulting Engineer.

[A copy of Mr. Lippincott's letter was submitted to Robert E. Horton, consulting engineer, Albany, N. Y., whose comment follows:—EDITOR.]

Sir—Relative to the matter of the importance and desirability of regular official inspection of United States Weather Bureau rain gages, I would say that I heartily indorse Mr. Lippincott's views on such inspection. I think it proper to add that, in so far as I can learn, lack of such inspection is no fault of the section directors who are in immediate charge of the stations. I know that some of these section directors feel very keenly the humiliating position in which they are placed by lack of provision whereby they can inspect rain gages in their territory.

I believe that we are just entering upon a new and greatly enlarged understanding and use of records of rainfall and stream flow. Existing shortages of food and fuel may be in part remedied by drainage and irrigation, in the one case, and by increased utilization of water power, in the other. Everyone knows the failures in such projects which have occurred in the past because of the use of inaccurate records, or the improper use of accurate records. It is exceedingly disappointing to an engineer, in working up an important hydraulic proposition, to find that records which should form the keystone of his investigations are not altogether above suspicion. Errors in such records can sometimes be eliminated by careful study, coupled with long experience and good judgment, but it is vastly better that the records should be right in the first instance.

There is another line of thought suggested by Mr. Lippincott's letter, and that is the real necessity for a greatly increased number of rainfall records in the United States. I believe that the records at regular Weather Bureau stations in cities should be continued by all means. Men in the cities want knowledge of weather conditions in the cities. Those records have their own use. As Mr. Lippincott's letter suggests, they are not so well adapted to the determination of the conditions in the surrounding country. I see no other adequate remedy for this defect than the establishment of additional stations.

There are many ways in which such records could and would be used, in addition to the ordinary uses to which they are put by engineers. They would furnish a better basis for weather forecasting, and for flood and frost prevention. I confidently feel that within a few years the cost of establishing and maintaining a greatly increased number of rainfall and temperature stations throughout the water-power, agricultural and navigation regions of the United States will produce economic results having a value very greatly in excess of the cost of the records. It seems to me proper to add, however, that one trouble heretofore has been lack of facilities to work up the records which have been accumulated and to make useful deductions therefrom. That should go hand in hand with increase in the number of records available.

Probably one reason why so few attempts at broad studies of hydrologic questions have heretofore been undertaken has arisen from the feeling that oftentimes the data are so meager and inadequate as not to justify the labor involved. That question would be eliminated by the establishment of such additional records.

There is about to be established an American Meteorological Society. As engineers are among the most extensive users of meteorological records, it would seem to me proper that they should be cognizant of and participate in the work of the proposed society. Furthermore, some method should be devised for getting direct practical results along the lines suggested by Mr. Lippincott. ROBERT E. HORTON,

Albany, N. Y. Consulting Hydraulic Engineer.

Finds No Competition in Society Employment Agency

Sir—In *Engineering News-Record*, Sept. 18, 1919, p. 579, is an article regarding a technical employment agency operated by the Colorado Society of Engineers. We would draw your attention particularly to the last paragraph. We, of course, have no objection to your boosting for the agency operated by the society referred to, but we object very strongly to the sentences in the last paragraph, as follows: "The paid employment agencies watch the activities of the organization closely. Their engineering business is reported to have dwindled since the engineers established the free bureau."

Neither of these statments is true in any way, and they do us an injustice. We pay no attention whatever to the agency referred to, and without looking up the matter could not even tell you where its offices are located. In our dealings with employers we have run across their track but once. As for our business having dwindled since they were established, we have more business at the present time than we can handle, and our business is showing a steady growth every month and every year. S. SERGEANT NEWBURY,

President, The Business-Men's Clearing House.

Denver, Colo.

The Fourteenth Census of the United States

Enumeration of population for the fourteenth census of the United States will be taken as of Jan. 1, 1920. Aside from population, the census will be restricted to agriculture (including irrigation), manufactures, forestry and forest products, and mines and quarries, and will cover the calendar year 1919. The authorizing act provides for a census of agriculture and livestock in 1925, also, and every 10 years thereafter, and for a census of manufactured products in 1921-23-25-27 and for every tenth year after each of those years. All 1914 census reports must be published by July 1, 1922. During the census period which will end on the date just named the director of the census will be paid $7500 a year; the assistant director, who must be "an experienced practical statistician," $5000; three chief statisticians for population, manufactures and agriculture, $4000 each; five other chief statisticians of divisions, $3600 each; and the geographer, $3000. Included in the list of minor officials [or employees?] is "one engineer" at $1200 and two photostat operators at the same rate. Skilled laborers are to be paid from $729 to $1000.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Carrying High-Tension Wires to Steam Shovels

ALL construction machinery on the new Queenston-Chippawa power canal of the Hydro-electric Power Commission of Ontario around Niagara Falls is electrically-driven, and practically all of it, particularly the steam shovels working in the deep cut of the canal, operates on a 4000-volt line with a transformer on the shovels. The accompanying view shows the portable

PORTABLE HORSES FOR HIGH-TENSION WIRES

connection from the main transmission line running alongside of the canal to a shovel which is in a cut immediately to the left outside of the view. This comprises a series of small horses about 6 ft. high, over the top of which the high-tension line is draped, each horse being marked with a conspicuous sign, reading "Danger—High Voltage." The fence around the pole from which the temporary line is taken off is also marked with a sign, not readable in the view, which has on it "Danger —4000 Volts."

Improper Winding on Engine Drum Injures New Rope

WIRE rope may be practically ruined by being reeled improperly onto the drum the first time or by the first few pulls, states James O. Hearne, logging superintendent, English Lumber Co., Mount Vernon, Wash., in a paper read before the Pacific Logging Congress held Oct. 8-11, 1919, at Portland, Ore.

There are several methods of reeling that are satisfactory. One is to wind from the reel to the drum, having the reel arranged on a rack for unwinding, and snubbing the wire between the reel and the drum to secure tight winding and proper spooling. A better method is to wind from the reel to the drum, taking no special pains with the winding, then run the line out with a haulback or other line and rewind carefully; the weight of the line and snubbing with the haulback gives the proper tension and spooling. Another method that is good is to run the wire off the reel at the warehouse, secure the ends properly, and drag it along the ground. The dragging tends to straighten the rope and put it in good shape for winding onto the drum.

For the first few days, the use of excessive loads should be avoided, the slack in the line taken up gradually, and the engine run at a moderate speed. This gives the strands and the wires in the strands a chance to adjust themselves to work together.

Special Rig for Jacking Up Bridge Spans To Renew Baseplates

BY CHARLES BAKER
Assistant Engineer, Wabash Railroad, St. Louis.

RECENTLY the Wabash R. R. was under the necessity of renewing two baseplates of the Missouri River bridge near St. Charles, Mo. Lack of space for jacking supports on the pier made this work difficult and required the use of special means for lifting the spans while changing the bases.

The bridge is on the main line between St. Louis and Kansas City; exclusive of approaches it consists of seven 300-ft. through truss spans. The original stone piers, built in 1870, are still in use, though the superstructure was replaced in the early 80's. While the trusses are still in good condition, the cast-iron baseplates on the center pier, known as No. 4, showed signs of failure this spring. The pier rests on solid rock and is about 100 ft. high. The upper 30 ft. is in the form of two columns 8 ft. square, with a curtain wall between them to within 10 ft. of the top. A cast-iron baseplate, 5½ x 7½ ft. 12 in. high, rests on each of these columns, one plate supporting a shoe of each of the adjacent trusses (the roller end of one and fixed end of the other). The spans resting on Pier 4 are Warren trusses, 318 and 315 ft. long c. to c. of end pins, built by the Keystone Bridge Co. in 1882.

As the stone columns of the pier were only slightly larger than the baseplates to be removed, and the height of the pier made the placing of bents in the river very expensive, the problem of obtaining sufficient bearing space for jacks to lift the spans constituted the principal difficulty. Advantage was taken of the rather ornate design of the pier to enable the necessary supports to be attached. At the bottom of the columns and curtain wall the width and length of the pier are increased, the offset being made with a series of beveled copings. (See sketch at left in Fig. 1.) These copings were cut down to form a seat for 12 x 12-in. posts held in place against the sides of the pier by 3 x 10-in. collars (right-hand sketch). Caps of 12 x 14-in. timber brought to the level of the top of the stonework supplemented the projection of the stone beyond the baseplates sufficiently to give bearing for the blocking under the jacks.

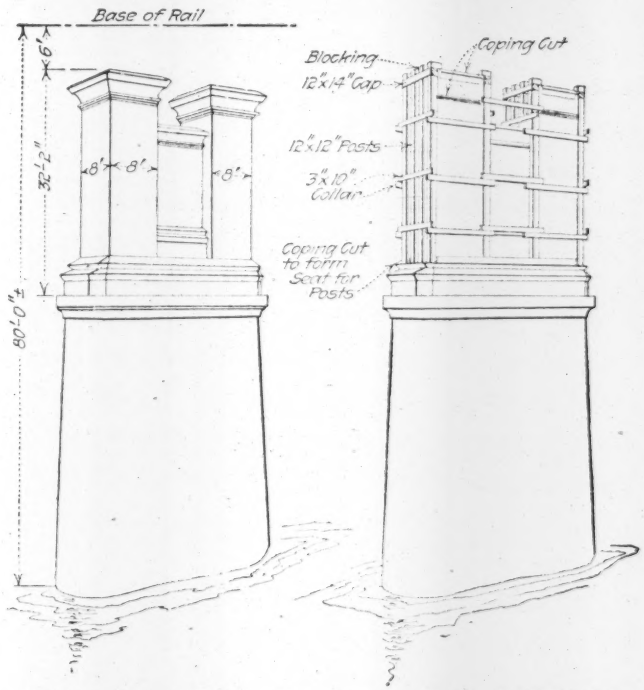


FIG. 1. SKETCH OF PIER AND JACKING SUPPORTS

The end pins were extended by pilot nuts to form a seat for 15 x ½-in. hanger plates, two plates to each end of each pin. The plates were bolted to two 12-in. channels which rested on four 24-in. I-beams set above the batter posts at right angles to the line of the bridge. These in turn rested on blocking under which were placed the jacks, as may be seen in the view, Fig. 2.

One baseplate was changed at a time, but, as it supported two shoes, a corner of each of the two adjacent spans had to be raised simultaneously. From data on the original plans for the superstructure the weight of the spans to be lifted was calculated as 200 tons apiece. Eight 100-ton jacks were used; according to the figures this would give less than 14 tons to the jack. No attempt was made to ascertain how much each jack carried, but the action seemed to indicate that it was greatly in excess of what had been expected.

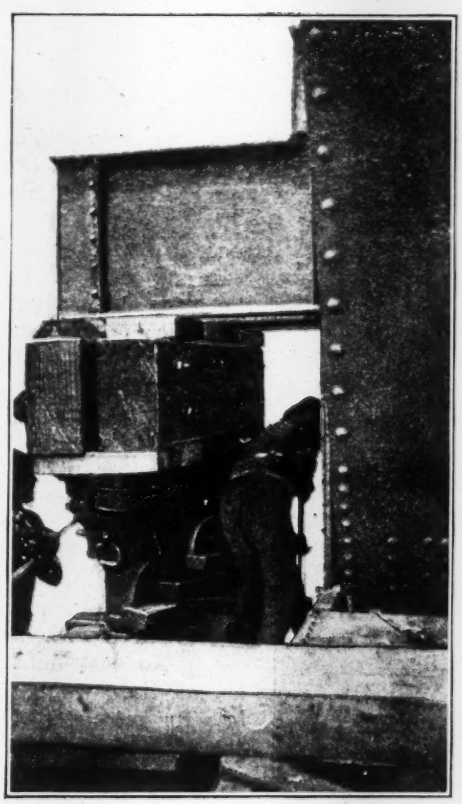


FIG. 2. JACKING UP ONE CORNER OF BRIDGE SPAN

As soon as the baseplate was relieved of the load, it was pulled out longitudinally with the bridge by means of a cable and ratchet jacks onto a scaffold hung from the lower chord. A similar scaffold on the opposite side of the pier held the new baseplate, a grillage of five 12-in. I-beams 7 ft. long, which was rolled into place simultaneously with the removal of the old baseplate. It was filled with concrete after being set.

The time consumed in making the change was about 4 hours for each plate. Freight trains were not running at the time, due to a strike of shopmen, and there was no interference with the passenger traffic. The work was done by the Kansas City Bridge Co., under the direction of A. O. Cunningham, chief engineer of the Wabash Railroad.

Templet With Saw Teeth Cuts Off and Finishes Concrete Surface

SAWING off and finishing concrete road to a true surface is accomplished by means of a new type of templet being used near Utica, N. Y. The cutting edge of the tool is equipped with teeth, and, moves back and forth, as is common in cutting with a straight edge. The contractors and engineers claim that it is a time and labor saver, besides being much easier for the men to operate than the hand tamping templet used heretofore.

A general view of the rear of the device is shown in Fig. 1. The main templet is constructed of a 3 x 12-in. plank cut to the desired crown and shod with steel. Attached to the front face of this plank is a 2 x 10-in. plank shod with horizontal saw-teeth at the base, as shown in Fig. 2. These teeth are similar to those on an ordinary mowing machine, but are shorter, being about 2 in. long. To hold the sawing section in the correct position, two rollers project from the 3-in. plank through strap-iron slots attached about 3 ft. from the ends of the templet.

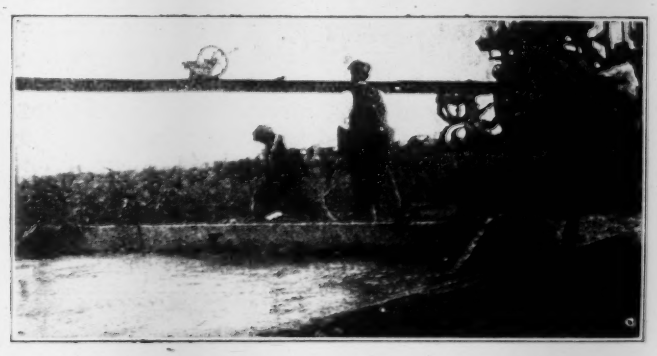


FIG. 1. REAR VIEW OF TEMPLET. NOTE HANDLES, CABLE DRUMS AND ROLLERS

Two upright handles produce the sawing motion and are used in furnishing motive power for the templet. The motive power is applied by stretching ⅛-in. steel wire cable from the templet to two stakes, one on each side and about 20 ft. ahead. These cables wind over the drums shown in the back of the templet, as they are revolved by a ratchet operated by the handles. As the

cable winds up the templet moves ahead with a sawing motion, and leaves a smooth and well flushed surface.

To facilitate the sawing motion, several rollers are set in the 3-in. planks so as to project and press against the

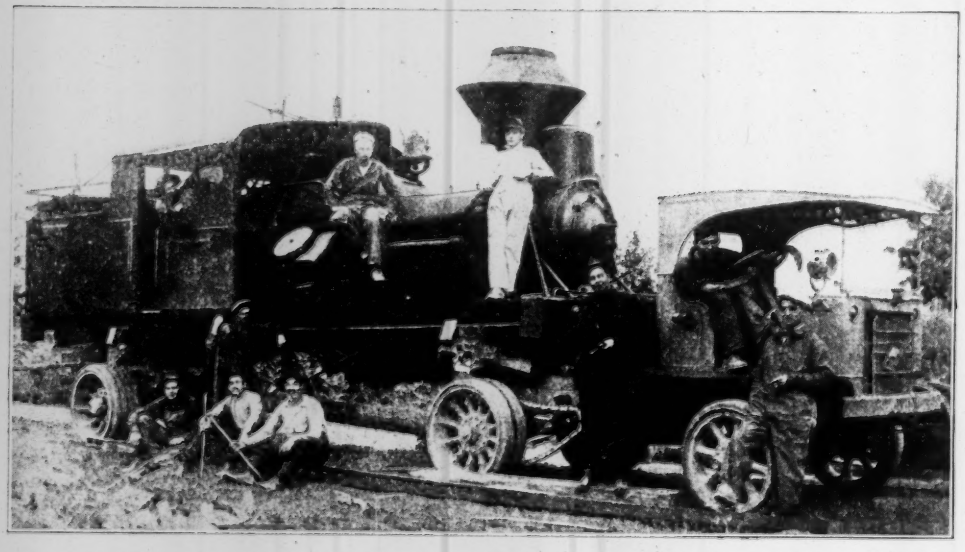
FIG. 2. FRONT VIEW OF TEMPLET, SHOWING TEETH AND SUPPORT OF CUTTING EDGE

2-in. sawing plank. Stability is given by the ⅜-in. strap-iron skids at each end. One man can easily operate the handles, though it is customary to have one at each end. It is estimated that two men can do as much work as four using the old tamping templet, and with much less effort. The screed is being used on New York State Highway work under the supervision of R. B. Graham, assistant engineer. The device was invented and is manufactured by James A. Lair, Amsterdam, N. Y., who, it is understood, has applied for a patent on the idea.

Locomotive Transported by Motor Truck in Northwestern Timber Lands

TRANSPORTATION of a large logging locomotive, as shown in the accompanying illustration, was accomplished in the timber lands of the Northwest by a Garford 10-ton tractor and semi-trailer. The locomotive is the property of the Clipper Shingle Co., Bellingham, Wash., and was moved by truck when it became necessary to transport it by highway from one timber claim to another.

The distance between the tractor and its trailer was first increased by substituting a timber reach for the usual connection. The locomotive was then lifted from its trucks by a derrick and mounted upon the prepared conveyance. Although the route was over rough forest roads, the operation was thus successfully completed.



LOCOMOTIVE BLOCKED UP FOR TRANSPORTATION ON TRACTOR AND SEMI-TRAILER

Improvised Backfiller Cuts Costs on Panama Sewer Job

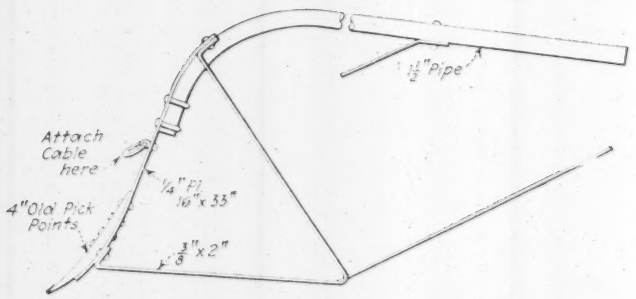
BY R. C. HARDMAN

Superintendent, Division of Municipal Engineering, the Panama Canal, Ancon, Canal Zone

IN THE backfilling of a large sewer trench in the City of Panama by the forces of the Division of Municipal Engineering under J. B. Miller, general foreman, a novel backfilling scraper was constructed from "scrap." It worked very satisfactorily in the material encountered, which was rock mixed with stiff clay.

The trench, which was approximately 6 ft. wide and 18 ft. deep, ran parallel to a railroad track. Upon this track the "power plant" for the scraper was operated. The power plant was built up from a small locomotive-crane truck upon which was mounted a horizontal boiler from a scrap well drill, an old hoisting drum geared to a well-drill engine and a snatchblock under the drum to permit of pulling the scraper from any angle.

The scraper was constructed as shown in the accompanying drawing and provided with four digging points



DETAILS OF IMPROVISED BACKFILLER

projecting from the plate 4 in. These points are essential when scraping in rock, as without them the scraper blade merely slides over the material to be moved. The braces on the back of the blades serve a twofold purpose, that of bracing the handles and that of preventing the blade from digging itself in too deeply. Lateral bracing not shown in the sketch was also provided. The bail for attaching the cable was rescued from an old hoist bucket.

The power plant was also used on the same job in connection with a short ginpole for pulling sheet piling. The cost of backfilling by this improved dragline was very low as compared with hand methods. No cost data are given, as they would be valueless for purposes of comparison with costs of similar work in the states, owing to the class of labor used on the isthmus.

NEWS OF THE WEEK

New York, October 30–November 6, 1919

Inter-Professional Body Formally Organized

Seeks to Bring All Professions Together on Common Basis of Discharging Obligations to Public

Following deliberations lasting through two days there was formed at Detroit, Nov. 29, the Inter-Professional Conference, the objects of which, to quote the declaration adopted, will be "to discover how to liberate the professions from the domination of selfish interest, both within and without the professions, to devise ways and means of better utilizing the professional heritage of knowledge and skill for the benefit of society, and to create relations between the professions leading to these ends." Membership will be open to professional men and women. The organization of the conference was purposely left loose so that it might work without too much restriction the first year, and then be free to cast itself into whatever form experience dictates to be advisable. Power to manage the affairs of the body was vested in a general council, to consist, at the beginning, of 21 members. Local conferences of professional men and women are to be formed in the large centers, the details to be worked out by the council. Dues were fixed at $1 per year. A sustaining membership of $10 was also established, while underwriting by members, limited to a maximum of $100, is also sought.

The dominating thought of the meeting was that the first obligation of the professional man is to the public, not to his client, and that his personal interest must come last. Starting with this premise, the purpose was to create an organization which would secure a wider acceptance of this obligation. That selfish interests are all too dominant and that the public's interests are generally given second rather than first consideration, was the confession of most of the professional men and women who responded on behalf of their professions to the opening remarks of Thomas R. Kimball, of Omaha, president of the American Institute of Architects. [Mr. Kimball's address is published in full on p. 808 of this issue.] Dean Henry M. Bates, of the University of Michigan Law School, spoke for the legal profession; Dr. George E. McKean, president of the Wayne County Medical Association, for the doctors; Dr. Charles H. Oakman, of Detroit, for the National Dental Association; Charles Whiting Baker, of New York, delegated by Engineering Council, for the engineers;

(*Concluded on page* 838)

This Week's News

This issue carries news current for the week ending Dec. 2. It is dated Oct. 30—Nov. 6, to preserve the sequence of numbers in the volume.

Builders' Committee Protests Coal Restrictions

Following the issuance, by the United States Fuel Administration, of the preference list for the distribution of coal, which practically cuts off the supply of all manufacturing plants during the strike, a builders' committee, appointed at a meeting held in Philadelphia, called on a representative of the Central Coal Committee in Washington, Nov. 24, to urge that construction activities be allowed to have coal. The preference list issued by the Railroad Administration and signed by H. A. Garfield, fuel administrator, is as follows: (a) Railroads; (b) Army and Navy; (c) Governmental institutions; (d) public utilities; (e) retail dealers. Manufacturing plants, jobbers and shipping follow.

It was pointed out to the builders' committee that the railroads have been forced to restrict deliveries of coal to the first five activities on the preference list, and that it would be impossible to make any general exceptions.

Would Enlarge Nitrate Plant

An additional appropriation of $12,000,000 to enlarge the Muscle Shoals, Ala., nitrate plant, and equip it for extensive production of nitrate for use as fertilizer during peace time, has been recommended to Congress by Secretary Baker. A bill to carry out the recommendations has been drawn by Chairman Kahn of the House Military Affairs Committee.

Grange Asks Highway Construction Cost Be Equalized

In the closing hours of the 53rd annual convention of the National Grange, held recently at Grand Rapids, Mich., a public highways report was adopted declaring for the unification of all Government highway activities in one single administrative body, and the equal distribution of expense of highway construction among the beneficiaries. In view of the number of bills pending, it was deemed inadvisable to approve any specific measure concerning highways.

Would Unite Profession in Single Organization

Joint Conference Committee of Four National Societies Outlines Plan for Comprehensive National Body

Including as its outstanding feature a recommendation for the formation of a single comprehensive organization to secure united action of the engineering and allied technical professions in matters of common interest to them, the report of the Joint Conference Committee, representing the development committees of the four national societies of civil, electrical, mechanical and mining and metallurgical engineers, was made public in the form of a pamphlet distributed last week among the members of the American Society of Civil Engineers. The proposed national body, it is stated, would provide "a voice to speak for the ideals of the profession, a hand to enforce unity of action and render the maximum of national, social and political service." The report pointed out, also, that the proposed organization would supply the machinery for united action on such questions as: The licensing and registration of engineers; national service committees; national Department of Public Works; conservation of natural resources; publicity; classification and compensation of engineers; general employment bureau; engineering education; international affiliation of engineers; industrial relations.

The desire of the four founder societies to provide for coöperation and solidarity among engineers was communicated to the Conference Committee by their respective development committees. The resulting plan of organization is designed to promote the desired end by providing an opportunity to use the strength of all existing technical associations in the country without taking from them any of their present privileges, or interfering with their respective fields of usefulness. It was the unanimous opinion of the Conference Committee that to make the engineering and allied technical professions a more active national force in economic, industrial and civic affairs, and to facilitate united action, it is desirable that there be coöperation through a single comprehensive organization. The report points out that Engineering Council can be molded into such an organization by making it more democratic. It could at the same time retain its present functions relative to the founder societies.

According to the report, such a na-

(*Concluded on page* 838)

Hearings on Townsend Bill Set for Late December

Owing to the stress of other matters, including the peace treaty, the League of Nations, and railroad legislation, Senator Townsend has announced that hearings upon his Federal highway bill will not be held until late in December or early next year. However, at that time, he said, the committee on post-offices and post roads would take up the measure, hold hearings, and put the bill in its final form for presentation to the Senate. For this reason it is important, says Senator Townsend, that those desiring to make recommendations regarding amendments send them in immediately.

Townsend Highway Bill May Be Dropped

(Washington Correspondence)

Such decided opposition to the Townsend bill has developed from the state highway departments that there is much doubt concerning whether the measure will be pushed. Any plan for national highways constructed directly by the Federal Government, it is believed, will be unpopular with the states, because only a limited portion of the state would be benefited directly by such a highway, while the Government with its road-building activities would be in competition for labor and supplies with the states and the counties. It is believed, also, that it will be very much easier for the Federal Government to hold the states up to a standard than to attempt to maintain the standard in its own work.

Those in favor of the Townsend bill admit that no plans have been made to secure its consideration at the present session of Congress.

Tallahassee Is To Have Manager

The commission-manager plan of city government was adopted by Tallahassee, Fla., at a recent election, by a large majority. Commissioners will be elected in January, 1920, after which they will appoint a manager. The salary of the manager as fixed in the act is said to be not less than $3000. G. P. McCord is Mayor of Tallahassee.

Chicago Votes Improvement Bonds

Public improvement bonds totaling $28,600,000 were authorized at the election in Chicago Nov. 4, including $2,000,000 to cover additional expenses on the Michigan Ave. widening and extension now well advanced. The new works to be undertaken are as follows: Robey St., widening and straightening and subways under railroads, $9,200,000; Ashland Ave., widening to 100 ft., $5,800,000; Ogden Ave. extension across city, $5,400,000; South Water St., widening and double-decking, $3,800,000; Western Ave., widening to 100 ft. for 25 miles, $2,400,000. Surveys and plans have been made in advance, and it is hoped that the court proceedings for acquiring the necessary property can be carried on expeditiously. The Cook County road-bond issue of $5,000,000, which also passed, will add 170 miles to the 197 miles already in use or completed this season.

Cleveland Orders Bond Issue Vote on Subway

On Nov. 24 the city council of Cleveland passed a resolution giving the rapid-transit commission authority to submit a bond issue of $15,000,000 to approval of the voters Feb. 10, the bond issue being for the construction of a subway system. The amount named corresponds to the cost of the system of four terminal loops recommended last summer by Barclay Parsons & Klapp, consulting engineers.

Railroad Executives Ask Emergency Law

The standing committee of the Association of Railway Executives, after an all-day session last week, issued a statement urging protective emergency legislation that will insure the roads the continuation of the payment of standard returns until final legislation is passed, and that will protect them by a continuance of rates in force during the period of Federal control, as well.

Indorse Public Works Bill

The Engineers' Club of Minneapolis, at its meeting Nov. 24, voted to support Engineering Council in educational work in the state to create sentiment for the Department of Public Works bill now before Congress. A committee was named to assist the Joint Engineering Board of Minnesota in presenting to the Congressional delegation at Washington the necessity for legislation permitting utilization of water power now being wasted at High Dam, Fort Snelling.

Twenty-one Colleges to Hear Lectures on Asphalt

Through the activity of the Asphalt Association a series of lectures on the properties of asphalt and on asphalt as a construction material is to be given in at least 21 Eastern, Middle Western and Southern universities and colleges. The lectures will be given during the coming winter. Among the colleges included are Harvard, Massachusetts Institute of Techology, Carnegie Tech., University of Illinois, University of Michigan, University of Wisconsin, Georgia School of Technology, Brown University, etc. The series includes three lectures, the first on "Asphalt," by Prevost Hubbard, Asphalt Association; the second on "Asphaltic Macadam and Asphaltic Concrete," by A. H. Blanchard, head of the Highway Engineering School, University of Michigan; and the third on "Sheet Asphalt" by Francis P. Smith, consulting engineer, New York City.

British Engineering Society Favors Registration

The Institution of Civil Engineers, London, announces that the result of a referendum vote of members favors by a large majority the registration of civil engineers. In July a proposal was placed before the institution that steps should be taken to obtain statutory powers to establish and regulate registration for the civil engineering profession. Following receipt of members' strong approval as expressed in the vote, the council of the institution has resolved to introduce a bill in the next session of Parliament with a view to attaining this object.

The institution's council announces that it has carefully studied the effect of the tentative bill on the interests of the public, the institution's membership, members of other important engineering societies, and persons now engaged in civil engineering practice who may not be connected with any such society.

The opinions and observations accompanying the letter ballots were factors in the framing of the bill, the details of which it was not possible for the council to make public until it had been deposited with Parliament. The principal provisions of the bill are a definition of the term "civil engineer" and the creation of a register which, as first established, would contain (a) all corporate members of the Institution of Civil Engineers and of the Institution of Civil Engineers of Ireland; (b) other persons who are engaged as civil engineers and are members of important engineering societies, or who, although not members of such societies, have been engaged in civil engineering practice for a substantial period. There would be set a time limit for the application of these conditions to the formation of a register. For the purpose of determining the eligibility of individuals comprised in the second group, a tribunal would be established upon which the important engineering societies would be duly represented, and by means of which the interests of their members who are civil engineers would be safeguarded.

New Jersey Ship Canal Being Agitated

The sea-level ship canal across New Jersey, linking up the Delaware River with New York harbor, is under serious consideration by a number of different interests. United States Army engineers have already recommended that such a canal is practicable, and the Secretary of War has submitted to Congress a recommendation that it be constructed. New Jersey already has committed itself to an appropriation of $1,000,000 for the acquisition of a right-of-way, and has passed appropriate legislation making it possible to cede the right-of-way so acquired to the Federal Government. In New York City, the New York-New Jersey

Port and Harbor Development Commission held recently a hearing on the project, at which a considerable amount of favorable sentiment was expressed, and the Chamber of Commerce of the State of New York has gone on record as favoring the construction of such a canal.

It is expected also that at the present regular session of Congress there will be an attempt to put the construction of such a canal into the current rivers and harbors bill.

Contractors' Association Sets Annual Dues

Subject to approval at the coming annual convention, the executive board of the Associated General Contractors of America has set the following annual dues for membership:

Class of Member	Average Annual Business	Annual Dues
A	Over $2,000,000	$250
B	$1,000,000 to $2,000,000	150
C	$500,000 to $1,000,000	100
D	$250,000 to $500,000	50
E	Less than $250,000	25

Two general classes of members, individual and association, will be admitted. Dues of member associations will be 20% of the annual income of the organization, provided that in no instance shall the total dues be less than $25 or more than $100 for each member of the member association.

Railroad Valuation Report To Be Ready January, 1922

At the office of Judge Prouty, director of the valuation of the railroads, in Washington, it was said that it was expected the final report on valuation would be made Jan. 1, 1922.

With the exception of the Eastern district, it was said, all road and track work on all the railroads throughout the country would be completed by the end of the present year. The work on the Eastern district has been held up, and it is not thought that it will be complete until September, 1920. The track and road work on the Southern district has already been completed, while the track and road work on the Central district will be finished, it is expected, by Jan. 1, 1920. With the exception of the Union Pacific Ry., in the Pacific district road and track work will be finished by Nov. 1. In the Western district road and track work is nearly completed. In every instance mechanical work has lagged behind road and track work.

Judge Prouty stated that he expected to make a final report on 75,000 miles of track by Jan. 1, 1920. Approximately 250,000 miles of track are involved throughout the country. It is calculated that it will take about two years to assemble the field data.

In the Eastern district the work of six of the twelve parties now operating in the field will be abandoned this winter on account of the difficulty in working under cold-weather conditions. This will involve the discharge of about 66 engineers.

Engineering Salaries Increased by New York City

Salary increases of 10% to 20% have just been granted to the municipal engineering employees of New York City by vote of the Board of Aldermen approving the 1920 budget as passed by the Board of Estimate recently. This action follows requests and arguments by engineering societies and a campaign of several months conducted by the local chapter of the American Association of Engineers. The Union of Technical Men and the Municipal Engineers were active in the campaign, and assistance was given by Engineering Council and the Brooklyn Engineers' Club.

Originally, a flat increase of $500 for every engineering employee of the city was requested. A full study of salaries was presented to the Board of Estimate by a committee of the American Association of Engineers headed by L. S. Benton. It recommended increases ranging from 20% for $5000 positions to 73% for $900 positions. L. B. Smith, assistant secretary of the association, delegated from the Chicago office to carry on the campaign, argued the subject before the Board of Estimate. For Engineering Council, the committee on compensation (A. S. Tuttle, chairman) urged the board to grant the increases asked for, as the committee's studies of municipal salaries, while not yet far enough advanced to warrant specific recommendations, showed that the recommended increases of 20% to 73% are conservative.

The increases granted to date from Jan. 1, 1920, are considerably smaller than those asked for. Engineering employees now receiving $1200 or less are increased 20%; those receiving $1201 to $1900, 15%; those receiving $1901 to $2600, 10% (except for larger increases in individual instances). A few increases have been made in salaries over $2600.

Engineers in the service of the Public Service Commissioner and the Transit Construction Commissioner are not included in the general budget. It is expected that the separate budget for these offices will provide for an increase of $300 for each employee.

Railway Association of Canada to Succeed War Board

It was determined that the Canadian Railway War Board should be abolished, at a meeting of leading Canadian railroad officials, held in Montreal recently, which formed the Railway Association of Canada to succeed the War Board. While the board will be abolished Dec. 1, the view was taken that it had accomplished so much in the way of coördination and efficiency that its place should be taken by another organization, with practically the same officers and functions. Lord Shaughnessy, honorary chairman of the War Board, was elected to the same office in the new organization, and Howard G. Kelley, of the Grand Trunk, chairman of the executive committee. Other members of the executive committee are A. H. Smith, president, New York Central R.R. Co., previously director, Eastern Region, United States Railroad Administration; D. B. Hanna, Canadian National Rys.; C. W. Beatty, president, Canadian Pacific Ry., and J. N. Beckley, president, Toronto, Hamilton & Buffalo Railway.

Railway Congress Reorganized

The International Railway Congress has been dissolved and reconstituted under the name of the International Railway Association, embracing only 35 countries, exclusive of the central powers of Europe.

Renewed Society Activity Among British Columbia Engineers

The British Columbia Technical Union has changed its name to the British Columbia Technical Association, and expects to absorb the Engineering and Technical Institute of British Columbia. This consolidation will bring the membership up to about 300.

The association has appointed an executive committee of members, in which are represented all the Vancouver branches of engineering societies, and it is planned to have this committee serve as a clearing house for all matters in which the coöperation of engineers is desirable. One of the first joint moves has been to invite the various engineering societies to select through this committee dates and topics for a series of lectures or talks this winter to each of which all engineers can be invited.

Eight committees have been appointed to take up the matter of the compensation of engineers, it being felt that this subject should have thorough attention in each of the eight branches concerned. The association maintains a paid secretary and has offices jointly with the Engineering Institute of Canada in the Board of Trade Building, Vancouver, B. C.

New Sewerage Board and More Sewers for Louisville

To expend $2,000,000 of sewerage bonds authorized at Louisville, Ky., a new or second sewerage board has been created, and appointments to it have just been made by George Wessinger Smith, mayor of Louisville, who is an ex officio member. The four appointed members are Oscar Fenley, C. C. Mengel, George T. Wood and Capt. W. W. Davies. The bonds will bear 4½% interest and run 40 years. It is expected that the board will create an engineering staff that will include a chief engineer and a designing engineer. It may appoint a consulting engineer also. A similar board was appointed in 1906, was in existence about eight years and expended $4,000,000 for intercepting and other sewers. John Chambers is city engineer.

Would Unite Profession

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tional engineering organization should have the following component parts:

1. Local affiliations, preferably under the auspices of local engineering societies or clubs, as follows: (a) Local "associations" or "sections" of the national engineering or technical societies; (b) local engineering societies; (c) other local engineers and members of allied technical professions.

2. A National Council, consisting of representatives of national engineering and technical societies and of representatives of local and state, or regional affiliations or organizations.

The function of local affiliations is to consider local matters of public welfare in which the engineering and allied professions are concerned, as well as other matters of common interest to those professions, followed by united local action thereon. The constitution and bylaws of all such local affiliations are to be approved by the National Council's executive board. The report states that the creation of state or regional councils is advisable in that such organizations could best study state matters of public welfare concerning engineering and allied technical professions, and apply remedies where necessary, but it is not stipulated that such councils are essential.

National Council to be Representative

The purpose of the National Council is to consider all those matters concerning engineering and the allied technical professions which have a national scope, or which have an interstate or interlocality character. The report presents the basis of representation thus: Each local, state or regional affiliation or organization whose membership is not otherwise represented through the national engineering or technical societies shall be entitled to one representative to the National Council for a membership of 100 to 1000, inclusive, and one additional representative for every additional 1000 members or major fraction thereof. Each national engineering or technical society shall be entitled to one representative for a membership of 200 to 2000, inclusive, and an additional representative for every additional 2000 members or major fraction thereof.

The plan stipulates that a national headquarters is to be maintained; stated annual or biennial meetings of the National Council are to be held; other meetings may be called by the executive board on its own initiative, and shall be called by it on direct request of 25 delegates to the National Council. Delegates are to serve four-year terms; the officers elected by the delegates are to hold office as follows: A president and a treasurer are to serve for two years, and two vice-presidents are to serve for four years. In addition, a permanent secretary is to be appointed by, and hold office during the pleasure of, the executive board. He is not to be a member of the executive board, however.

Council's Executive Board

There is to be an executive board with the function of directing the activities of the National Council in accordance with the latter's adopted policy, and have such additional functions as may be assigned to it by the National Council. The executive board is to consist of (a) the four officers elected by the National Council; (b) one representative for each national society of 2000 members or less, with one additional representative from each national society for every additional 2000 members or major fraction thereof, to be selected from the membership of the National Council in each case by the national society concerned; (c) a number of representatives selected from the membership of the National Council by the representatives therein of the local, state or regional affiliations or organizations, which number is to bear the same ratio to the representatives of the national societies as the total membership of the local, state or regional affiliations or organizations bears to that of the national societies.

The proviso is made, however, that the numerical basis of representation shall be so changed from time to time that the membership of the executive board shall not exceed 30. The president and secretary of the National Council are to be the chairman and secretary, respectively, of the executive board.

The plan provides for the admission of any national engineering or technical society or any local, state or regional affiliation or organization to representation on the National Council by the submission of its written request to the secretary of the National Council, together with such data regarding its aims and status as the bylaws may provide. The secretary is to refer the request to the executive board, which in turn submits it to the delegates together with its recommendation for a letter ballot. The applicant is to be admitted by a majority vote of the National Council, provided that not more than 25% of that body shall vote in the negative.

In order to finance the National Council and its executive board, the report prescribes the following assessments: Each national society represented on the National Council shall contribute annually $1.50 per member; each local, state or regional affiliation or organization represented on the National Council shall contribute annually $1 per member.

The report of the Joint Conference Committee also contains opinions and recommendations on the subject of coöperation in society activities. The committee reported that although a great many matters of urgent character were presented for its consideration, in the two and a half months of its existence it had been able to consider only the more important ones, the most vital of which was the general organization of engineers for public activity. The general plan, as outlined above, is now before each of the founder societies for its consideration and approval.

Inter-Professional Body Formally Organized

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Miss Lena M. Phillips, of New York, executive secretary of the National Federation of Business and Professional Women's Clubs, for professional women, and Basil M. Manly, of Washington, for the economists and journalists. There also appeared representatives of the American Library Association, of the State Geologists' Association, of the teachers, and of the nurses.

The members of the general council so far chosen are F. L. Ackerman, Felix Adler, Robert D. Kohn, E. J. Mehren, Calvin W. Rice and Lena M. Phillips, all of New York; Thomas R. Kimball, Omaha; C. T. Chenery, Basil M. Manly, and Charles H. Whitaker, Washington; Dr. W. G. Ebersol, Cleveland; Dr. Gillette Hayden, Columbus; Paula Laddey, Newark, N. J.; M. B. Medary, Philadelphia; W. W. Bishop and Miss D. M Barnes, Ann Arbor, Mich.

The office of the conference is at 56 W. 45th St., New York City.

Labor Conditions in Portland, Oregon

(From "Engineering News-Record" Correspondent)

Portland, Ore., Nov. 26—Only one shipyard in Portland, the Columbia River Shipbuilding Corporation, is on a closed-shop basis. As very little work is being done at this yard, the company calls one man "chief draftsman" and another "clerk" and thus "sidesteps" the union requirements. There are some union draftsmen at the other yards, and a few at the city hall, but this affiliation does not count either for or against them.

O. Laurgaard, city engineer, says: "We do not ask a man whether he is a union member or not, and I, personally, do not know whether all or none of our draftsmen belong to the union, nor do I care."

In the railroad offices a few union men are found, but their superiors do not seem to care any more about that than they do about their religion.

Portland Local, No. 23, was organized among the shipyard men to protest against a proposed reduction of wages, and nearly all of the city hall draftsmen joined at that time, but now only a small percentage of the city men are union members.

The energetic chapter of the A. A. E. in Portland has been a strong factor in keeping the radical element from getting a very strong hold here.

American Association of Engineers' Chairmen

The American Association of Engineers has announced the appointment of chairmen of national committees for the ensuing year, as follows:

Americanization—Garrison Babcock, consulting telephone engineer, Chicago.

Education—Professor Frederic Bass, University of Minnesota, Minneapolis.

Ethics—Isham Randolph, consulting engineer, Chicago.

Finance—Glen Vivian, accounting department, Bureau of Statistics, Chicago, Milwaukee and St. Paul Ry., Chicago.

Highway—R. C. Yeoman, chief engineer, Indiana Sand and Gravel Association, Indianapolis.

Legislation — W. H. Whipple, chief engineer, Lime Association, Washington, D. C.

Membership—R. W. Barnes, principal assistant engineer, Southern Pacific Ry., Portland, Ore.

Municipal Engineering—S. C. Hadden, editor of *Municipal and County Engineering*, Chicago.

Practice — H. W. Clausen, general office manager, C. D. Osborne Co., Chicago.

Program—L. Winship, assistant engineer, Missouri Pacific Railroad Co., St. Louis, Mo.

Public Relations — L. K. Sherman, president of the United States Housing Corporation, Washington, D. C.

Publications and Publicity — W. W. Horner, chief engineer, City of St. Louis.

Qualification—A. C. Irwin, engineer, Structural Bureau, Portland Cement Association, Chicago.

Salaries of Engineers in Public Service—A. N. Johnson, consulting highway engineer, Portland Cement Association, Chicago.

Canal Makes Wells Dry Up

As a result of the building of the power canal between Chippawa and Queenston by the Ontario Hydro-electric Commission, about 60 wells in Stamford Township, within half a mile of the ditch cut through the rock for the canal, have dried up. The township council of Stamford seeks to hold the commission responsible, but the latter refuses to admit any liability. The council has been advised that it cannot bring an action as an organization, but that the farmers interested must sue individually. A test case will be brought unless an amicable settlement can be made.

Plan New Railroad in Western Quebec

It is reported that the Canadian Pacific Ry. is considering the extension of the Kipawa branch in Western Quebec to a distance of 65 miles to the north end of Lake Timiskaming. It is likely that a large paper mill will be erected at the lake in proximity to water power capable of developing about 200,000 horsepower.

Drainage Congress Urges Laws for Federal and State Aid

Land drainage as a necessary factor in the problem of increased production was one of the main matters advocated at the annual meeting of the National Drainage Congress, held at St. Louis on Nov. 11—13. That funds and active assistance should be provided by the United States Government in the development of drainage projects was the familiar attitude taken by several of the speakers, and it was represented in some of the resolutions. A different viewpoint was taken by F. H. Newell, formerly director of the United States Reclamation Service, in an address which was almost a warning concerning the future work of the Drainage Congress. He sees very little prospect of large appropriations for work of this kind, and considers that individual enterprise is needed at present. On the other hand, there is still a tendency to regard the smaller projects as local or neighborhood matters, so that broad vision, clear understanding and engineering assistance are missing factors. Public sentiment is a strong factor in promoting such developments, and one of the duties of the Drainage Congress should be to create such sentiment and thus help in the progress of both large and small projects.

Sanitary aspects of drainage, applying especially to malarial districts, were discussed by Dr. T. H. D. Griffitts, U. S. A. In some cases improvements such as roads actually tend to increase bad conditions by checking drainage flow, and he urged that engineers should give full attention to providing ample capacity in the way of culverts and bridges. Furthermore, in view of the influence which insanitary conditions of living have upon the existence and spreading of disease, he suggested that in providing for the settlement of newly drained areas consideration should be given to the disposal of human excreta and refuse.

While Dr. Griffitts discussed drainage conditions relative to swamp lands, Prof. C. F. Shaw, of the University of California, discussed those relative to irrigated lands in the semi-arid regions. Not only does irrigation tend to cause waterlogging of the ground, with resultant rising of alkali salts to the surface, but it causes groundwater to stand at so high a level as to be injurious to crops. It is found very necessary to educate irrigation farmers concerning this latter condition. He considered drainage to be a necessary supplement of irrigation and a matter not to be left until land has been damaged by excess of water. As a supplement to this, a speaker from Iowa voiced the opinion that ditches are not sufficient in themselves and that no farm is properly drained unless it is so tiled that the farmer can work on the ground 24 hours after the heaviest rain. Flood protection as applied to the Mississippi River was discussed by Col. C. McD. Townsend, United States Engineers, who showed the development from the old policy of building levees which would allow severe floods to pass over them, to the present policy of building levees high enough to confine the maximum floods within the river channel.

Satisfactory financial results of drainage work were cited by Isham Randolph, consulting engineer, Chicago, who referred to the Little River drainage district of Missouri, with an area of some 800 square miles. Numerous other speakers referred to districts where lands that were worthless and sold at $15 to $25 an acre are now sold at $200 or more ($800 in one case). Drainage bonds as investment securities were discussed by Edward Bower, banker, Cleveland, Ohio. He showed the necessity of high-class engineering as well as legal work, and thought that drainage districts should employ consulting engineers to review the projects and plans of the drainage engineers and thus provide for a broader view of the situation. Transportation, markets and soil characteristics are important factors in the development of a district, while good business management is an essential which has been overlooked in so many cases as rather to throw a cloud upon drainage bonds.

Resolutions Passed

Resolutions were adopted in favor of the following: (1) Federal and state aid of drainage and other projects for the development of natural resources, but upon a financial plan providing for the return of the money advanced within a reasonable time; (2) Federal laws to authorize and aid interstate drainage projects, whose development by individual enterprise is difficult if not impossible, the immediate control of all interstate drainage being left with the states; (3) state laws guaranteeing the payment of interest charges on sound drainage securities; (4) Federal laws to encourage the construction of canals and the improvement of navigable rivers in order to promote water transportation and provide outlet channels for drainage waters; (5) Federal and state aid in the completion of a standard topographic map of the country, together with closer coördination of the several mapmaking agencies of the Government; (6) the Jones-Reavis bill for the establishment of a national Department of Public Works; (7) indorsement of the Government action during recent labor troubles, and the deportation of aliens who counsel opposition to the United States Government.

The committee on legislation reported plans to secure drainage planks in the party platforms for 1920. The committee on engineering referred to defects in existing laws, and was continued for the purpose of making investigations along this line. Edmund T. Perkins, consulting engineer, Chicago, was reëlected as president. The next meeting is to be held at Atlanta, Ga., in 1920.

Engineers in India To Unite in Single Society

Body Embracing All Branches of the Profession, to Hold Inaugural Meeting At End of This Year—2000 Members

Partly as the outcome of a recommendation contained in the Indian Industries Commission Report, a society of engineers is being formed in India embracing all forms of engineering. Various attempts have been made in recent years for the collaboration of members of engineering institutions in England and America who are resident in India, but nothing had previously been done, chiefly owing to want of support from the parent bodies.

The various institutions of civil, mechanical, electrical and mining engineers have from time to time met in various parts of India, and certain conferences and congresses of railway and of Public Works Department engineers have been held, but these have all been local, and there has been a great need of a movement such as the one now under way.

E. M. HUGHMAN, ORGANIZING SECRETARY OF NEWLY FORMED INDIA SOCIETY OF ENGINEERS

Sir Thomas Holland, K. C. S. I., K. C. I. E., who was president of the Indian Industries Commission and later president of the Indian Munitions Board, in 1918 took the lead, and opportunity was taken of the joint meeting held in Calcutta in December, 1918, of the English and American electrical institutions, to extend this meeting to engineers of all branches. The outcome is the formation of the Indian Society of Engineers. Sir Thomas has been ably supported by the leading engineers resident in India. E. M. Hughman, honorary secretary of the India Centre of the English Institution of Electrical Engineers, was appointed honorary organizing secretary, with the support of a strong committee formed to undertake the necessary steps for the formation of the new society. Mr. Hughman is now in the United States, and in addition to taking care of his private interests has been studying engineering society developments in this country. He is seeking also to enlist the interest and support of the leading national engineering societies of the United States, for the new society will admit members of the American societies to the new body on a par with those who belong to the English institution. In fact, members of the American societies are active in the formation of the Indian Society of Engineers.

The organizing committee was instructed to consult the existing engineering congresses in India, all chambers of commerce, the port trusts, the railway conferences, the Mining and Geological Institute of India, as well as the local representatives of the English and American institutions and societies of engineers. The committee was also instructed to consult with the heads of the civil, military and marine engineer services, and particularly with representatives of the Provinces of India, Burma and Ceylon, where engineering organizations were not then in existence.

All Organizations Coöperate

The first work of the organizing committee, therefore, was to obtain the coöperation of all these provincial organizations, and for that reason Mr. Hughman, with the organizing committee, visited such centers as Calcutta, Bombay, Delhi, Lahore, Karachi. Representatives from Burma, Madras and Ceylon attended some of these meetings, with the result that the organizing committee was able to obtain the solid coöperation of these bodies as well as the united support of members of the various engineering institutions resident in India, Burma and Ceylon.

India is so vast a country that it is practically impossible for engineers belonging to one institution to meet members of the same institution in other towns, as the big centers are at least two days' train journey apart, and the territorial difficulties are immense. By means of this new society of engineers each center will have its own organization. There must, of course, be one headquarters, where a central library will be instituted, but each center will have its own library and all the facilities required to enable the members to obtain the knowledge of progress and research which go on in other parts of the world, and to meet and exchange their ideas.

The qualifications for membership in the new society are based on the rules of the English Institution of Civil Engineers, the object of the society being the advancement of all branches of engineering science in India. The rules have been drawn up very strictly, and it will be impossible for anyone to join the society who is not fully qualified to join his home institution or society for such branch of engineering as he has taken up. Members of recognized and approved bodies, which are to include the national American societies, will be eligible for membership in the new society, and those members of the new society who do not belong to their home institutions will be urged to take up such membership.

The inaugural meeting of the new society will take place toward the end of the present year, and His Excellency the Viceroy and Governor General of India will preside.

Government Gives Support

The Government of India strongly supports the formation of the society, and it has already been indicated that the Government will ask the society to deal with such questions as engineering standards for India and matters affecting the engineering departments of the Government. It is understood also, from promises already given, that the question of a charter will have the support of the Government of India.

The education of the Indian engineer in India will not be overlooked, and it is the intention also to look after the welfare of the members, particularly with regard to the salaries of engineers in Government and private service.

An ample guarantee fund has been subscribed by the members, and a paid secretary has been appointed in the person of Major Brady, R. E., an experienced engineer with sound journalistic training, as well as an organizer of exceptional merit.

Late news coming from India to Mr. Hughman indicates that 2000 members have already been obtained, assuring successful inauguration of the new body.

Discussing engineering society organization in this country, Mr. Hughman pointed out that engineers in India are doing what we are trying to do here—secure an affiliation of all the branches of the profession. He believes that such an affiliation must be effected in England, too, where at present the great institutions have no coördinated activities.

Illinois Will Pay for Road Materials on Delivery

Additional contracts for 1000 miles of paved roads in Illinois will be awarded in 1920, according to a statement made to *Engineering News-Record* by Clifford Older, chief highway engineer, Division of Highways. Ten surveying parties are now in the field laying out the routes and preparing plans, and as soon as the construction season closes the number of surveying parties will be increased to 30 or 40 organizations. The letting of contracts for 1920 construction will begin about Jan. 10.

Conditions relating to materials supply for 1920 construction will, it is believed, be very serious. This year's experience with railway transportation has been discouraging. The shortage of open-top cars has been extreme. Besides, the addition of 1000 miles of road to the considerable mileage of 1919 contracts which will continue over into 1920 will require so large a percentage of the capacity of available commercial

plants that some difficulty in obtaining aggregates for concrete may be expected. The remedy sought is to lengthen the producing season of the aggregate plants by purchasing and storing aggregates on the job during the winter when the necessary cars are available.

To inaugurate this movement for winter storage, the Division of Highways will pay contractors for sand, gravel, stone, etc., as delivered. Vouchers will be issued directly to the railways for the freight charges and to the producers for materials, and the amounts will be charged against the contractors and will be deducted from the contractors' estimates as the materials are consumed. This arrangement will apply to existing uncompleted contracts as well as to the new 1920 contracts.

Urge Retention of Massachusetts Highway Commission Members

A number of past presidents and members of the Massachusetts State Highway Association, in a recent letter, have urged Governor Coolidge to retain the present members of the State Highway Commission during the organization of the new Department of Public Works. The plea is based on the excellent record maintained during the 27 years in which the commission has been in existence. The letter says, in part:

In 27 years since the organization of the highway commission was formed, it has had but 10 different members—strong testimony to the soundness of its organization and policies, and there has been no change in its chairman or its personnel in seven years. In the past 20 years, as you well know, the system of Massachusetts state roads, acknowledged to be the finest in the country, has been developed. In the same period the great business of administering the motor-vehicle law has been organized.

Despite the fact that it has handled over $35,000,000 in public funds, the honesty, integrity and efficiency of this commission has never been questioned, which record is unique among highway departments in the United States. Its administraion has been absolutely clean.

Furthermore, the methods of road construction it has originated and the highway and motor-vehicle laws it has formulated have been copied by practically every state in the Union.

This commission has always been the leader in the development of new types of highways to meet changes in the character of the traffic and to improve motor transportation ,and its specifications have been the highest standing wherever roads are built. It was the leader in the introduction of bituminous materials in road construction, it inaugurated the sand-oil road and introduced other roadmaking methods now widely known and employed. The road census, recognized as a most valuable method of forecasting the character of road needs for future travel, was first introduced in the United States by the Massachusetts commission. In its motor-vehicle work the commission has established the standards that have been followed everywhere, and in its difficult position which combines legislative, judicial, and executive functions, it has been notably free from criticism. It has the distinction of operating the motor-vehicle department so economically that almost 90% of the total money paid to the state in motor vehicle fees is used directly on the roads.

In view of these facts, we feel that it would be a serious loss to the state and to those who make and use the highways, which comprises practically the whole population, if in the organization of the new Department of Public Works all of the present members of the Highway Commission are not retained. Such action on your part will continue existing policies that have proved satisfactory from every point of view, and we believe will meet with the approval and commendation of the citizens of Massachusetts.

Car Shortages Big Limiting Factor in Road Construction

Lack of rolling stock for the transportation of road materials has been and still is the greatest limiting factor in highway construction, and is responsible for at least 50% of what 1919 contract work remains unfinished, in the belief of Thomas H. MacDonald, chief of the Bureau of Public Roads. Lack of materials, inability to interest a large percentage of the more efficient contractors in road work, lack of trained highway engineers, and scarcity of common labor are the other four limiting factors named by Mr. MacDonald in the order in which they have affected highway construction, in his opinion.

Lack of materials has been brought about largely by inability to get cars, for, if ample cars had been available capital would not have hesitated to develop additional materials, he believes. Demands in other construction lines have been so great as to keep most of the large contractors out of road work, though this condition is changing very markedly at present, he states, and within the past few weeks several large contracting organizations have taken over road-construction work. To a Chicago firm have been awarded 80 miles of concrete road work in Illinois, the usual unit for a contract of this class of work being only from five to six miles.

The small effect that the general labor shortage has exerted upon road construction is explained by Mr. MacDonald as a result of the intensive use of mechanical equipment. Few common laborers, he asserts, are needed, the demand being chiefly for men with mechanical knowledge.

The Federal-aid plan for highway construction has made available more money during the 1919 season than it was found possible to expend efficiently. A like condition is predicted for 1920. With such conditions prevalent, Mr. MacDonald urges unusual scrutiny in road expenditures in order to prevent waste.

Delaware Highway Department Holds Annual Meeting

In order to indicate to the public what must be demanded in road construction, and in order to stress the point that more engineers must become capable of building good roads economically, a road exhibit, combined with the annual meeting of the Delaware State Highway Department, was held Nov. 20-22 in the lobby of the du Pont Hotel, Wilmington, Del.

In the exhibit were included a complete model of a hydrated lime plant, a section of Delaware road showing brick on concrete foundation with a cement-sand cushion, laboratory equipment for testing materials, samples of materials in use, photographs of all the developments during road construction, and other items of definite educational value for both roadbuilders and for those who pay for the construction of the roads.

The meeting of the Highway Association was held Nov. 22, and included in the program were six papers presenting technical features, and three touching upon the general aspects of the road situation. Emphasized in these three discussions was the thought that money for construction is forthcoming, but that roads must be worthy of the expenditure made upon them, or else a sharp and damaging reaction will be met.

Evidence of the change in sentiment regarding roadbuilding from several years ago was brought out by the fact that some of the early opponents of the du Pont highway, traversing the state from north to south, were numbered among the men who organized the Delaware Good Roads Association Nov. 22, an organization of which Charles M. Upham, chief engineer of the State Highway Department, was chosen president.

With Mr. Upham presiding, the following program of papers was read at the meeting: "Road Situation," by Josiah Marvel, commissioner; "Survey and Preparation of Plans for State Highways," by Arnold Richardson, assistant engineer; "Design and Construction of Highways, Bridges and Culverts," by C. N. Conner, bridge engineer; "New Methods in the Construction of Concrete Roads," by C. S. Gale, construction engineer; "Methods of Testing Materials Entering Into State Road Construction," by G. W. Hutchinson, testing engineer; "Acquiring Right-of-Way for State Highways," by C. S. Gale and J. E. Tate; "Construction of Bituminous-Macadam Roads," by W. E. Hawkins, Sussex County engineer; "History and Statistics of the State Highway Department," by W. W. Mack, assistant engineer, and "History, Ethics and Practices of the American Association of Engineers," by R. C. Bailey, Washington, D. C.

Large State Road Projects

Seventeen road projects in Pennsylvania, which have been approved by the Bureau of Public Roads, will cost $4,607,000, for which the Federal aid is $1,969,000.

The figures of the bureau, which just have become available, show that during July Nebraska obtained the approval of projects aggregating the greatest mileage. Oklahoma had the largest single project, of which the estimated cost is $1,271,556.

One Massachusetts project, which was approved recently, will be constructed at an estimated cost of $127,864 a mile. This is the highest average cost per mile so far shown in any Federal-aid road. One Ohio project is expected to cost $66,716 a mile; another one in Pennsylvania will average $64,015, while still another Pennsylvania project will be constructed at an estimated cost of $56,443 per mile.

To Reorganize Boston's Supply Bureau

Officials of the City of Boston have long realized the inefficiency of the present Bureau of Supplies. It has remained for Mayor Peters to take a drastic step and provide for an effective department. He has asked the firm of Stone & Webster of Boston to make an investigation and recommend the necessary changes.

Civil Service Examinations

United States

For United States civil service examinations, listed below, apply to the United States Civil Service Commission, Washington, D. C., or to any local office of the commission, for form 1312.

Town manager, $2400 per year, Dec. 16. To fill vacancy in Ordnance Department, Nitrate Plant No. 1, Muscle Shoals, Ala. File applications before Dec. 16.

Structural steel inspector, Naval Ordnance Plant, South Charleston, W. Va., $7.04 per diem, Dec. 23. File applications before Dec. 23.

Civil engineer, Philippine service, $2500 to $3000 per year. Applications received until further notice.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

NATIONAL RIVERS AND HARBORS CONGRESS, 824 Colorado Building, Washington, D. C.; Dec. 9-11, Washington, D. C.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.; Dec. 8-11, Louisville, Ky.

BRIDGE BUILDERS' & STRUCTURAL SOCIETY, 50 Church St., New York City; Jan. 16, New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 W. 39th St., New York City; Jan. 21-22, New York City.

ENGINEERING INSTITUTE OF CANADA; General Secretary, Fraser S. Keith, 176 Mansfield St., Montreal; Jan. 27-29, Montreal.

AMERICAN ROAD BUILDERS' ASSOCIATION, 150 Nassau St., New York City; Feb. 9-13, Louisville, Ky.

AMERICAN WOOD-PRESERVERS' ASSOCIATION; Secretary-Treasurer, F. J. Angier, Mt. Royal Station, Baltimore; Feb. 10-12, Chicago.

AMERICAN CONCRETE PIPE ASSOCIATION; 210 South La Salle St., Chicago; Feb. 20-21, Chicago.

Castle Post of the American Legion, composed of engineers of all schools and from many branches of the Engineer Corps of the Army, who served from Chicago, met Nov. 25 in the rooms of the Western Society of Engineers and elected the following officers: Commander, Robert I. Randolph; vice-commander, Myron B. Reynolds; adjutant, Walter A. Wade, 1400 First National Bank; finance officer, Eugene C. Heron; directors, C. Vandeventer and Arthur R. Lord. Plans have been undertaken looking to a close study of the industrial side of military requirements.

The Rochester, N. Y., Engineering Society was addressed Nov. 28 by Mathias R. Kondolf, who spoke on the proposed Kondolf state act in regard to the survey and fixing of boundaries within the state. At the luncheon Nov. 25 Prof. Dexter Perkins spoke on "Why We Should Save the Treaty," and on Dec. 2 C. Solon Kellogg spoke on the "Soft Coal Situation."

The Montreal Branch of the Engineering Institute of Canada was addressed Nov. 27 by W. E. L. Dyer on "Railway Track: Design and Manufacture." On Nov. 28 and 29 members of the society visited the Montreal branch of the St. Lawrence sugar refinery.

The Engineers' Club of Lansing, Mich., completed its organization at a meeting Nov. 17, having been organized by members of the Michigan Engineering Society. Its membership is not restricted, however, to members of the Michigan society. Meetings will be held twice a month. The officers elected for the ensuing year are Otto E. Eckert, president; C. E. Bement, vice-president; Fred L. Radford, secretary-treasurer, Reo Motor Car Co., Lansing.

The Idaho Society of Engineers voted Nov. 16 to amalgamate with the American Association of Engineers, under the title of **the Idaho Society of Engineers' Chapter of the American Association of Engineers.**

The New England Water Works Association will hold its December meeting at the Hotel Brunswick, Boston, Dec. 10. The following papers are included on the program: "My Trip to France," by Col. Richard K. Hale; "Modern Pumps for Small Water-Works," by A. O. Doane, and "Description of Motor-Driven Portable Thawing Machine Mounted on Truck," by Frank J. Gifford. The report of the committee on budget for 1920 will also be presented.

The Southern California Association of Members of the American Society of Civil Engineers was addressed Nov. 12 by H. Hawgood on "Cost of Flood Damage and Economic Relations," continuing the discussion of "Flood Control." The committee on universal military training submitted its report in favor of training for a reasonable period of time. Careful study of the report of the committee on development was urged.

A New Haven, Conn., Chapter of the American Association of Engineers may be the result of the recent organization of professional engineers in New Haven, at a meeting held Nov. 21, at which the following temporary officers were elected: E. B. Muny, president; Philip Sellers, vice-president; G. B. Taylor, treasurer; Irving Alpert, secretary, 113 Asylum Street.

The Oklahoma Society of Engineers, Nov. 24, selected Tulsa as the next place of meeting, in October, 1920.

The Engineers' Club of Trenton held a special meeting Dec. 1, at which Fred C. Carstarphen spoke on "Time, Space and the Theory of Relativity."

PERSONAL NOTES

RUSSELL W. STOVEL, recently lieutenant colonel of engineers, U. S A., has been appointed consulting engineer, Westinghouse, Church, Kerr & Co., Inc., and has become a member of that organization. He will devote his entire time to the company's electrical and mechanical work. He served in France as chief of the terminal facilities division of the Army Transport Service. He was graduated from McGill University in 1897, with the degree of electrical engineer, and the following year entered the employ of Westinghouse, Church, Kerr & Co. He soon became an assistant engineer, then successively engineer-in-charge, mechanical engineer of the company and finally mechanical engineer. In 1914 he left the company to become managing engineer for Gibbs & Hill, consulting engineers, New York, and was in charge of the Paoli and Chestnut Hill electrification of the Pennsylvania R.R., the Elkhorn grade electrification of the Norfolk & Western Ry., and the electrification of the New York Connecting Railway.

CAPT. PAOLO. TUCCIMEI, a member of the executive board of the Associated Engineers of Italy, is in the United States to attend the International Trade Conference as one of the delegates from Italy. Captain Tuccimei was an officer of artillery in the Italian Army, serving four years on the Austrian front. Prior to the war the engineering profession in Italy had 37 different organizations, all of them local. Need for a national engineering organization was made manifest during the four years of war activity, and the Associated Engineers of Italy was organized last April. In September it had attained a membership of 4000, and it is expected to have as members, within a few months, practically all of the 10,000 professional engineers and architects in Italy. Only university graduates are eligible. The local engineering societies will become sections of the new national association.

R. WINTHROP PRATT, consulting engineer, Cleveland, Ohio, has opened a branch office in Detroit, Mich., at 88 Griswold St., with H. A. STRINGFELLOW in charge.

ARTHUR L. BOMAN, Federal-aid project supervisor, Nebraska State Highway Commission, has been appointed city engineer and superintendent of the water-works of Kansas.

H. F. JOHNSON, for the past year and a half with the Construction Division of the Army and the United States Housing Corporation, has become superintendent, Joseph E. Nelson & Sons, Chicago, and is at present in charge of terminal building improvements for the Chicago, Rock Island & Pacific Ry., at Cedar Rapids, Iowa.

GEORGE S. LONG, previously water-works engineer, Camp Meade, Maryland, has become assistant engineer on sewer design with the Department of Public Service, Akron, Ohio.

RALPH S. HEATH, for the past several years in charge of engineering and construction work for the Navy Department on dry dock No. 4, Norfolk, Va., Navy Yard, and on the coaling plant at the Pearl Harbor station, Hawaii, has become engineer for the M. J. Roche Construction Co., Cincinnati.

CAPT. WILLIAM MICHENER, Engineers, U. S. A., has become assistant professor of military science and tactics, Alabama Polytechnic Institute, Auburn, Ala.

JOHN F. BUCKNER, formerly city engineer, Cleburne, Tex., has become secretary of the Rush County, Texas, Highway Commission.

E. W. METCALF, formerly assistant field engineer, Pacific district, Department of Valuation, Interstate Commerce Commission, has been appointed assistant engineer, Missouri, Kansas & Texas Ry., at Dallas, Tex., assigned to valuation work.

CAPT. LEROY E. GARDNER, Construction Division, U. S. A., has returned to his former work as resident engineer for CHARLES T. MAIN at New Bedford, Mass.

H. B. BILFORD, resident engineer, Illinois State Highway Department, has resigned to become resident engineer, Ohio State Highway Department for Brown County, with headquarters at Georgetown.

W. F. LAWRY, who recently finished his work as chief draftsman for the Kipawa Co., Ltd., at Timiskaming, Quebec, has become designing engineer, Algoma Steel Corporation, Sault Ste. Marie, Ontario.

R. W. FELIX, previously captain, Construction Division, U. S. A., has become associated with the Lakewood Engineering Co. as sales engineer, with headquarters in Pittsburgh.

CAPT. THOMAS G. MACCARTHY, U. S. M. C., recently discharged from the service, is now with N. S. HILL, JR., and S. F. FERGUSON, consulting engineers, New York City, as civil engineer.

THOMAS J. SCULLY, formerly captain, 214th Engineers, has become associated with the Constantia Lumber Corporation, with offices in New York City and Constantia, N. Y.

GEORGE SIDNEY BINCKLEY, previously major, Engineers, U. S. A., has become associate editor of *Ingeniería Internacional*, McGraw-Hill Co., Inc. Since 1890 Mr. Binckley has been engaged in civil engineering work in Mexico and in the West. Previous to entering the Army in 1917 he was engaged in private practice in Los Angeles, Calif.

ALFRED E. STROBEL, structural engineer, formerly with the Chicago, Burlington & Quincy R.R., on the design of the Harrison St. freight terminal, has joined the staff of the Kniskern Construction Co., Chicago.

LIEUT. LAYTON F. SMITH, U. S. N., recently discharged from the service, has reopened his office at 218 N. Charles St., Baltimore, Md., for the practice of engineering and architecture.

W. C. DAVIS, formerly first lieutenant, Engineers, U. S. A., has been appointed manager in charge of the office of the United States Gypsum Co., Builders' Exchange Bldg., Cincinnati.

GUSTAV HIRSCH, previously lieutenant-colonel, U. S. A., has resumed private practice with offices in the Hartman Bldg., Columbus.

CECIL N. HAGGART has resigned from the American International Shipbuilding Corporation to resume his former work in engineering and contracting with headquarters in the Fitzsimmons Bldg., Pittsburgh, Penn.

JEREMIAH HANNAFIN has been appointed superintendent of streets and highways of Winsted, Conn.

S. B. RAMBO has been elected city engineer of Greenwood, S. C.

CAPT. E. N. PETERSON, Corps of Engineers, U. S. A., recently resigned from the service, has resigned from H. L. COOPER & CO., consulting engineers, New York City, to become associated with the Franco-American Agency, 54 Rue Taitbout, Paris, France.

CHARLES ASH, resident engineer on construction of the Scioto River bridge, Broad St., Columbus, Ohio, has been appointed deputy state highway commissioner, assigned to duty in the bridge bureau.

ROBERT D. MCCARTER and WILLIAM L. COOPER have become associated under the firm name of MCCARTER & COOPER, and will engage in consulting engineering and purchasing for clients, with offices at 50 Church St., New York City.

ALEXANDER MACOMBER and JOHN WEST, who since 1910 have been associated with CHARLES H. TENNEY & Co., engineers and managers of public utilities, Boston, have become associated with GEORGE P. CARVER, industrial architect and engineer, under the firm name of CARVER, MACOMBER & WEST, INC., engineers, 261 Franklin St., Boston.

JAMES M. WOOTEN, recently returned from service in France, has resumed his position as chief engineer, Kentucky River Power Co., Hazard, Ky.

CAPT. JOSEPH R. GREENWOOD, U. S. A., recently discharged from the service, has renewed his association with the firm of CHARLES H. HIGGINS, architects and engineers, located at 19 West 44th Street, New York City.

HOWARD B. LUTHER, instructor in civil engineering, Massachusetts Institute of Technology, has been appointed assistant professor of civil engineering.

OBITUARY

HENRY LAWRENCE GANTT, industrial engineer, New York City, died at his home in Montclair, N. J., Nov. 23, after a brief illness. He was a native of Calvert County, Maryland, and was educated at Johns Hopkins University and at Stevens Institute, from which he was graduated in 1884. He was closely associated with the late Fred W. Taylor in the original development of scientific management, and his active professional life was devoted to this work, in which he rendered service to manufacturing concerns in many different fields. Early in his work he rejected the theory that the function of scientific management was merely to get more out of the employees, believing it should embrace a high degree of co-operation between employees and the management. He was active in the American Society of Mechanical Engineers. He was the author of "Work, Wages and Profits," published in 1913, "Industrial Leadership," published in 1916, and "Organizing for Works," published in 1919.

W. T. WILSON, former county highway engineer, Fulton County, Georgia, died recently in Atlanta.

Handbook on Export Methods Issued by Government

A handbook entitled "Selling in Foreign Markets" was recently issued by the Bureau of Foreign and Domestic Commerce of the Department of Commerce, Washington, D. C. It was prepared in conjunction with the Federal Board for Vocational Education. The book of 638 pages aims to discuss in a practical way all the aspects and problems of export trade. It consists

mainly of reports and articles by experts of wide experience, either in large private business or commercial investigations for the Government.

The bureau issues this book with the opinion that it affords an unusual opportunity for Americans interested in oversea trade to obtain information that will enable them to profit by the training and skill of others and to acquire pertinent authoritative information concerning the manifold phases of effective salesmanship abroad.

Copies can be obtained for 50c. each from the Superintendent of Documents, Government Printing Office, Washington, D. C., the order name being "Selling in Foreign Markets," Miscellaneous Series No. 81.

Cement Export Firm Elects Officers

The Cement Export Co., an association of 11 portland cement manufacturers whose annual production approximates 15,000,000 bbl., the organization of which was noted in *Engineering News-Record* of May 22, 1919, p. 1036, has elected the following officers: President, Charles S. Conn, Giant Portland Cement Co.; first vice-president, Joseph A. Horner, Nazareth Cement Co.; second vice-president, J. W. Alker, Pennsylvania Cement Co.; secretary, Morris Kind, Hercules Cement Corporation; treasurer, Joseph Brobston, Dexter Portland Cement Co., and general manager, F. C. Green.

The association has secured terminal facilities in New York City for the storage of about 50,000 bbl. of cement. From 5000 to 50,000 bbl. will be kept in stock so that all orders can be promptly filled. Representatives of the export company have left to develop the export market in the Argentine Republic and in Brazil.

Janney Process for Reproducing Tracings Improved

Improvements have been made in the Janney process, for the reproduction of tracings, whereby it becomes a one-man instead of a three-man operation. The floor space occupied by each machine will be reduced at least 75% and the time required for the reproduction of each tracing will be reduced from 30 to 10 min. The improvements have been made by Reynold Janney, originator of the process, and president of the Waterbury Tool Co. of Connecticut, and E. S. Holland, of the E. S. Holland Co., New York City.

The process, as described in *Engineering News-Record* of Feb. 27, 1919, p. 451, is based upon the gelatinizing of a zinc plate with sensitized gelatin, which, after being refrigerated and maintained at the proper temperature, receives the impression of a matrix blueprint made on special transfer paper, such a blueprint being neither developed nor washed.

Flat tables, upon which gelatinizing and inking were done, and the refrigeration chest, have been replaced in the new design through the utilization of an electrically driven cylinder whose surface is of zinc and which is gelatinized and refrigerated simultaneously. The cylinder is gelatinized from below through contact with the gelatin in a trough easily adjustable; is refrigerated from within through its attachment to a small refrigeration plant, and is inked in much the same manner as is employed by cylinder presses.

The new device is now being perfected, patents have been applied for and the manufacture of the new machine will soon be started.

Western Wood Pipe Manufacturers Form Publicity Bureau

Four of the largest manufacturers of wood pipe on the Pacific coast have formed the Western Wood Pipe Publicity Bureau, with offices in the White Bldg., Seattle, in charge of E. J. Bartells, manager. The four companies uniting in the work are the Continental Pipe Manufacturing Co., Seattle; American Wood Pipe Co., Tacoma; Redwood Manufacturers Co., and the Pacific Tank and Pipe Co., both of San Francisco.

BUSINESS NEWS

THE FEDERAL BRIDGE & STRUCTURAL CO., Waukesha, Wis., has reopened its contracting and sales office in the People's Gas Bldg., Chicago, with M. E. Allen as contracting engineer in charge of sales. Mr. Allen was formerly in charge of sales for the Central States Bridge Co., Indianapolis, Ind., and later was associated with the Baily & Allen Co.

THE DEWEY CEMENT-GUN CONSTRUCTION CO., Allentown, Penn., has been reincorporated under the name of THE TRAYLOR-DEWEY CONTRACTING CO., and announces that, in addition to its previous work, it is prepared to estimate upon and to undertake the construction of roads, pavements and buildings.

THE READING IRON CO. announces the appointment of Comly B. Shoemaker, Jr., as assistant superintendent of the Roe puddling department.

THE RICHARDSON-PHENIX CO., lubrication engineer and manufacturer, Milwaukee, has reopened its Philadelphia office, which is in charge of George F. Fenno, recently released from Government service.

CHARLES F. AMES & CO., New York City, has appointed Paul D. Goodman, previously of the Epping Carpenter Pump Co., Pittsburgh, as sales manager, sales department, Plate Iron Works, Dayton, Ohio.

THE PARSONS-MOORHEAD MACHINERY CO., 237 Fourth Ave., Pittsburgh, Penn., has been organized to do a general machinery business.

THE HOFMANN-SPROUL CO., manufacturer of iron and steel, Philadelphia, has appointed the Faison Co., Banner Bldg., Greensboro, N. C., as representative for the South.

THE INTER-STATE MACHINERY CORPORATION has been formed to succeed the Ralph R. Lewis Co., retaining the same management and offices in the Commercial Trust Bldg., Philadelphia, Penn.

TRADE PUBLICATIONS

The following companies have issued trade publications:

THE MACHINERY EXCHANGE CO., New Orleans; booklet, 10x7 in., 24 pages, illustrated, including insert of line drawing showing arrangement of aërial, radial crane and cableway for handling coal.

THE PORTLAND CEMENT ASSOCIATION, booklet, 9x6 in., 36 pages, illustrated, entitled "Concrete Tanks for Industrial Purposes."

THE FRANKLIN MANUFACTURING CO., Franklin, Penn.; catalog, F.C., 7-19, 11x8 in., 78 pages, illustrated, including information on heat insulations and "Franklin Fuel-Saving Products."

THE GEORGE HAISS MANUFACTURING CO., INC., New York City; booklet 619, 9x6½ in., 16 pages, illustrated, on coal, stone and sand elevators and conveyors.

THE DAVIS-BOURNONVILLE CO., Jersey City, N. J.; circular, 6x3 in., eight pages, illustrated, describing the Davis flare light and generator.

THE ALEXANDER RAILROAD CROSSING & EQUIPMENT CO., Chicago; folder, 8½x3½ in., illustrated, describing swing rail construction of "shockless" railroad crossings.

THE F. C. AUSTIN CO., INC., Chicago; catalog, 11x7½ in., 12 pages, illustrated, describing the "Austin Wagon Loader."

THE HOWE CHAIN CO., Muskegon, Mich.; catalog No. 4, 9x6 in., 24 pages, illustrated, describing "Howe Trucking System" and equipment for industrial plants.

THE BLAW-KNOX CO., Pittsburgh; bulletin 203, 9x6 in., 28 pages, illustrated, describing "Blaw Forms" for light walls and foundations.

THE TITAN TRUCK CO., 25th and St. Paul Aves., Milwaukee, Wis.; booklet 8½ x 11 in., 20 pages, illustrated; showing salient features of the Titan 3½-, 5- and 6-ton trucks; illustrations indicate the uses to which the Titan truck is put for hauling material on contract work.